SMALL BUSINESS INNOVATION RESEARCH (SBIR) PROGRAM OVERSIGHT AND REAUTHORIZATION

HEARING

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SUBCOMMITTEE ON GOVERNMENT PROGRAMS AND OVERSIGHT

OF THE

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SMALL BUSINESS INNOVATION RESEARCH (SBIR) PROGRAM OVERSIGHT AND REAUTHORIZATION

THURSDAY, MAY 27, 1999

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON GOVERNMENT PROGRAMS
AND OVERSIGHT,
COMMITTEE ON SMALL BUSINESS,
Washington, DC.

The Subcommittee met, pursuant to call, at 10:00 a.m., in room 2360, Rayburn House Office Building, Hon. Roscoe G. Bartlett (chairman of the Subcommittee) presiding.

Chairman BARTLETT. Good morning. Let me call our Subcommittee hearing to order and then immediately announce that we must recess. They have just called a vote. That was the bell that you heard and the two lights that you see on the clock up there. They have called a vote. So we will need to recess momentarily for the vote. It should take me about 10 or 12 minutes to get to the vote and back again, if this is the only vote and if there are no announcements there.

So we will stand in recess until this vote is ended.

[Recess.]

Chairman BARTLETT. Our Subcommittee will reconvene.

Good morning. Let me call the Subcommittee to order.

It is a pleasure to welcome you to this hearing of the Subcommittee on Government Programs and Oversight of the House Small Business Committee. I would especially like to thank those of you who have traveled some distance to participate in this hearing.

The hearing will examine the performance of the Small Business Innovation Research, SBIR, program which was signed into law by then President Ronald Reagan on July 2, 1982. It was most recently reauthorized in 1992 to extend through the end of fiscal year 2000.

While the SBIR program enjoys bipartisan support because it has been successful, we have a responsibility to examine every government program for continued effectiveness and to consider ways in which they can be improved. I always want to make sure that the Federal government gets its money's worth from Americans' hard-earned tax dollars.

The SBIR program fosters innovative research and development by small businesses and strengthens the country's technology base. The SBIR program has been credited with creating new jobs, in-

creasing productivity and economic growth and helping combat inflation and stimulating exports. Small high-tech companies, as a group, have shown an ability unequaled by large businesses to produce new products, processes and technologies. The program finds widespread support among members of both parties.

The hearing will provide program oversight and a basis for legislation reauthorizing the program. The Committee will examine recommendations for legislation and administrative changes that you may offer during the hearing. Your views concerning the present and future operation of this important program are most welcome.

Again, welcome to our participants and guests. I look forward to hearing your comments on this most important program.

I am pleased that we are joined by Mr. Hill and would ask if he has an opening statement.

[Mr. Bartlett's statement may be found in the appendix.]

Mr. RICK HILL. No, I don't have, Mr. Chairman.

Chairman BARTLETT. We will hold the record open for opening statements from all the members of the Subcommittee who wish to submit them. And I will stipulate before we begin that, without objection, all of your prepared remarks will be included in the record, and we would encourage you to summarize your remarks. That way, we will have adequate time for expanse during the question and answer exchange.

I have read your testimony. I was particularly impressed that 50 percent of our witnesses are women. We have held several hearings on women-owned small businesses, and I was surprised to learn that women-owned small businesses are growing at twice the rate of male-owned small businesses.

By the way, women-owned small businesses have a lower bankruptcy rate than male-owned small businesses. The bankers haven't figured that out yet, because women still have difficulty with access to capital.

Women-owned small businesses are better employers. They are more compassionate, more sympathetic. They are more focused on their employees. That shouldn't surprise us either. Men and women are different. The military yet hasn't figured that out, but men and women are different.

And so I am very pleased that 50 percent of our participants today are women. Because this is the fastest-growing part of our economic community, particularly the fastest-growing part of our small business community.

We are very pleased that you have been able to join us today. Mr. Al Behar, is that how you pronounce your name?

Mr. BEHAR. Behar.

Chairman BARTLETT. President and CEO, Personal Improvement Computer Systems Incorporated; Dr. Judy Armstrong, President and CEO, ADA Technologies, Incorporated; Dr. Jacqueline Haynes, Vice President/Owner, Intelligent Automation Incorporated; and Dr. Arvid Larson, Co-chairman, AAES R&D Task Force.

We will proceed with the testimony in the order in which I welcomed our witnesses. Mr. Behar.

STATEMENT OF MR. AL BEHAR, PRESIDENT AND CEO, PERSONAL IMPROVEMENT COMPUTER SYSTEMS, INC.

Mr. BEHAR. Mr. Chairman, thank you for the opportunity to tell you our story and give you my input on the SBIR program. My testimony will focus on PICS's unique approach to tackling tobacco addiction and other health problems related to diet and exercise that face the United States and other industrial nations, the success that PICS has enjoyed thanks to the SBIR program and recommendations for its potential improvements.

Before I get on with my testimony, I would like to express my appreciation to the SBIR program and its administrators at every level of the National Institutes of Health. In particular, I would like to acknowledge the fine work of Mr. Sonny Kreitman who, until his recent retirement, provided strong leadership to this program.

I also would like to compliment Mr. Kreitman's successor, Ms. Jo Anne Goodnight. I have had the pleasure of meeting with Ms. Goodnight recently and am confident that she will do an excellent job coordinating the SBIR program.

Finally, I would like to thank the NIH program officers and grants management staff for their advice on the full spectrum of issues that we have faced over the years.

As you well know, tobacco addiction is the leading cause of premature death worldwide. Yet in the U.S. and Canada alone over 50 million people smoke and about 10 million people chew tobacco. Despite the vigorous anti-tobacco campaigns in both countries over the last 10 years, these numbers have remained virtually unchanged.

The second leading cause of premature death in industrial nations is heart disease and strokes caused by combinations of obesity, elevated cholesterol, hypertension and diabetes, all of which are diet and exercise related.

PICS' unique approach to tackling these major health problems has been the development of self-help programs that are implemented by hand-held computers. Today, our family of products help hundreds of thousands of people battle tobacco addiction, lose weight, control cholesterol and lower hypertension.

PICS has developed two computer platforms, LifeSign and DietMate, which are used in a variety of products. LifeSign is a credit-card-sized computer that is the basis for four products that deal with the treatment of tobacco addiction: LifeSign for Adult Smokers, LifeSign for Pregnant Women, LifeSign for Dippers and Chewers, and most recently LifeSign for Teens and Young Adults.

Our DietMate program, family of products, in fact, is based on a palm-size computer and comes in three versions: weight loss, cholesterol reduction, and high blood pressure treatment.

Because of the scope of the problems that we address our work has enormous public health significance and enviable commercial potential. In fact, the combination of self-help convenience and hand-held portability coupled with the power of computers to personalize treatment yields uniquely efficacious products that are popular with users and are easy to disseminate widely and quickly. Clinical trials have shown that our LifeSign Stop Smoking program matches the efficacy of drug treatments at a fraction of their cost

and without the risk of side effects. Not surprisingly, LifeSign and DietMate has sold over a million units worldwide and have generated over $100 million in sales. To date, LifeSign has enjoyed success in the U.S., Canada, Latin America, Australia, Japan and numerous European countries.

PICS employs about 20 full-time people and several consultants through outsourcing. We have been awarded three patents for our LifeSign and DietMate technology.

The SBIR program has allowed PICS to engage in extensive product development that normally would be reserved only for large corporations. SBIR has helped us pioneer innovative approaches to major health problems which have earned us the respect of the scientific community, while allowing us to capitalize on our rigorous research efforts by commercializing our product ideas. Furthermore, the SBIR program has allowed us to maintain a degree of stability despite the many ups and downs experienced by small businesses.

There is a great deal right with the SBIR program as currently administered. However, there are always opportunities to improve on a good thing.

Over the last few months we have been working diligently with members of the NIH administrative staff in developing additional recommendations aimed at streamlining the application process and modernizing the review process. My more detailed recommendations are included in my written testimony.

Here I would like to highlight one key recommendation related to Phase I funding. The present $100,000 limit on Phase I, although adequate for many fine projects, falls short of what is needed to attempt to tackle some of the more complex health issues that our society faces today, such as AIDS and cancer. In contrast, I have found the $750,000 limit on Phase II sufficient. Therefore, my recommendation is limited to increasing Phase I funding level to $200,000.

In closing, I would like to thank you again for giving me the opportunity to express my opinion on the performance of the existing SBIR program and offer my recommendations for potential improvements. Thank you.

Chairman BARTLETT. Thank you very much.

[Mr. Behar's statement may be found in the appendix.]

Chairman BARTLETT. Dr. Armstrong.

STATEMENT OF MS. JUDY ARMSTRONG, PRESIDENT AND CEO, ADA TECHNOLOGIES, INC.

Ms. ARMSTRONG. Chairman Bartlett, I want to thank you for the invitation to testify today. I will read an excerpt of my written testimony.

My business, ADA, has been an active participant in the SBIR program since its award—first award in 1985. Today, ADA is a company of 35 scientists and engineers with annual sales of $4 million.

I would like to spend my time giving you some background information on ADA, looking at its activities in light of the four purposes of the SBIR program, including some general comments on technology commercialization. Finally, based on my years of con-

versations with others interested in the program, I have three recommendations I would like to offer.

From the first days ADA has searched hard to find the best researchers in the country for the areas in which we proposed to get SBIR funding. We talked to universities, professors, other small businesses and large businesses. Alliances with others have always been a key to our success.

We learned to be profitable and to build infrastructure. We learned how to use government funds for our own R&D projects, giving us competitive advantage through ownership of a broader scope of intellectual property.

We began to seek commercialization of innovative, proprietary technology as a path to faster growth and more net income and also as a means of adding value and providing benefits to our clients and the Nation.

ADA's strategic focus today is to improve the lives of the world's populations through innovative technology. In the last 5 years, ADA has produced two innovative technologies that we believe achieve this goal. In 1996, ADA Environmental Solutions was formed to help the Nation's utilities comply with the Clean Air Act Amendments while providing the Nation with the power it needs on an efficient basis. ADA sold ADA Environmental Solutions in a stock and cash deal valued at $8.3 million.

ADA technology innovation has also been the genesis for Tek-Gear LLC of Jackson, Wyoming, now operating from Boulder, Colorado. Tek-Gear manufactures a datalogger, Trekker, which is being sold today to allow high school students to conduct efficient, state-of-the-art laboratory and field experiments.

Among the technologies of the future from ADA are likely to be more efficient demand-defrost control units for the millions of industrial refrigerators, software modules and games to improve science learning by students of all ages, and cost-effective mercury-control technology that will enable utilities to comply with future clean air amendments and requirements.

Relative to the four purposes of the SBIR program, to stimulate innovation ADA has received nine patents and has one patent pending. The commercialization of our technology ties closely to these patents.

We use small business to meet Federal research and development needs. ADA has worked closely with several DOE departments to help them meet their R&D needs. With SBIR funding, ADA has been able to pursue cost-effective techniques and to develop capabilities that will now assist the government with establishing reasonable environmental regulation. Early development of these advanced technologies by ADA allows the EPA and other government agencies to formulate strategies for managing the environment that have substantially lower costs and future investment needs while at the same time forming the basis for products that will meet the needs of the private sector.

Purpose three, to foster and encourage participation by minority and disadvantaged persons and women-owned businesses. ADA has been woman-owned since its inception in 1985. I believe the SBIR program has allowed me, a mathematician, to approach technology innovation from a perspective that differs from that of the majority

of scientists and engineers. I rely heavily on instinct, intuition, people skills and relationships in going about my business, all recognized characteristics of women in leadership roles. The Phase III commercialization activities needed for success come naturally to me and allow me to coach members of my staff to see the importance of people and relationships in the technology process.

Purpose four, to increase private sector commercialization of innovations derived from Federal R&D. ADA's R&D activities have resulted in a return on investment to the Federal government of over 320 percent from commercial activity. The government has invested $6.6 million in ADA through the SBIR program, and ADA has returned over $21 million in matching funds from commercial industry.

In closing, I have three recommendations that I would like to make. The first one is that the SBIR program has proven its success and requires no legislative changes. This highly competitive program works efficiently. I believe talented technologists with the will and commitment can use the SBIR program as it exists to prototype new ideas and attract funding to complete a commercial product. I do not believe the fundamentals of the program should be changed.

Second, the program should be extended at least 10 years. The SBIR program has been dramatically successful meeting the goals set by Congress. I firmly believe this will continue.

I expect two additional things to happen in the next few years. First, a new round of companies and technology champions will be created using the ever-increasing skills of the next generation of graduates from our universities and colleges. Second, a transition in ownership and leadership will occur in the companies already participating in the program. The next 10 years will see many of those companies now meeting the purposes of the program formulating and implementing successful transitions to a new round of leaders.

Third and last, a national mentoring program should be put in place. We need to reach out and get more businesses involved in the SBIR program to keep it highly competitive and successful. In my written testimony I speak to this in my story about SBIR Colorado, an organization that was operational in Colorado for 6 years. Mentoring entrepreneurs in areas that may not be collocated with a university or Federal laboratory will help achieve this goal.

Again, I want to thank you for the opportunity to offer this testimony; and I will be happy to entertain any questions that you have.

Chairman BARTLETT. Thank you very much.

[Ms. Armstrong's statement may be found in the appendix.]

Chairman BARTLETT. Dr. Haynes.

STATEMENT OF DR. JACQUELINE HAYNES, VICE PRESIDENT/ OWNER, INTELLIGENT AUTOMATION, INC.

Dr. JACQUELINE HAYNES. Good morning, Mr. Chairman and members of the Subcommittee. My name is Jacqueline Haynes. I am the owner of Intelligent Automation Incorporated, a small business located nearby in Montgomery County, Maryland. It is an

honor for me to address the Committee to discuss reauthorization of the SBIR program.

I founded IAI with my husband, Leonard Haynes, 13 years ago, using an extra bedroom in our home as our office. You can imagine the DCAA auditor's surprise when he showed up there for our first audit. We have grown now to an organization of nearly 50 technical staff, housed in an office building in Rockville, Maryland. We attract first-class engineers, computer scientists and social scientists from as far away as Taneytown and Frederick, Maryland, to the north and Springfield, Virginia, to the south. We also have small offices in Arizona and Connecticut; and we currently have subcontractors and consultants located in 11 other states.

From its beginning, my business has grown through the SBIR program. Our government clients have found us to be quality partners in their R&D programs, and I believe that this quality accounts for the success we have experienced in winning Phase I and Phase II awards from many government agencies. And now we are experiencing success in transitioning many of the technologies originating from our SBIR work into the commercial sector by either licensing our technology or selling related products and services to and through large firms such as Motorola, Ford, American Airlines, Nichols Research and to law enforcement agencies throughout the U.S. and in many foreign countries.

The SBIR program has been an engine of growth for us, and we have been very successful in achieving the goals of the SBIR program. We have grown from doing $160,000 in business our first year to a projected $6 million this year. We are an SBIR success story, but it doesn't end there. We reinvest nearly all the profits of our SBIR-related work into continued R&D and commercializing the technologies that we see have potential. Government agencies, taxpayers and the Nation's economy in general get a lot for their money from our work.

Our business goal is to realize our profits from commercialization. SBIR funding is the means and the beginning, but not the end. Our first year, about 95 percent of our business came from the SBIR program. Now, approximately half our business is external to the SBIR program.

In nearly every case our commercial business is the direct result of the technology we developed through the SBIR program. It is important to understand that many of the greatest success stories stemming from the SBIR program would never have seen the light of day had they been solely dependent on venture capital and other funding sources. My experience is that venture capital will not fund creativity or innovative ideas if they don't lead directly to a near-term product. Good science takes time, and development takes many attempts, and financiers often don't understand that. The SBIR program is one of the few players accessible to small businesses in supporting high-risk innovation and creativity. Yet this is what leads to the new products that fuel our Nation's competitive edge.

I would like to highlight now some of the major technological developments of my company that were made possible by the SBIR program, first in the area of forensics imaging technology.

Based on SBIR-funded research, we have become a world leader in forensics imaging technology. Over half the crime labs in the United States and several foreign countries have our ballistics analysis system called RotoScan. This work began through a Phase I SBIR with BMDO where we developed a new type of neural net called a Fuzzy CMAC which turns out to be very useful for image analysis. We teamed with a company that is now part of Nichols Research to use this approach for automating matching of bullets retrieved from crime scenes to a data base of known gun signatures left on bullets. The resulting RotoScan is now one part of the FBI's Drugfire system. We have sold over 110 RotoScan units that are located in crime labs throughout the U.S. and in many more foreign countries. Now with additional SBIR, non-SBIR and private commercial investment, we are developing a three-dimensional version of RotoScan which will yield major improvements in the technology and the role that it can play in forensic science.

Also coming from our RotoScan success we received a contract, a non-SBIR contract, from the Drug Enforcement Agency and Nichols Research to build and design PillScan, which is a similar device for the forensic analysis of illegal and counterfeit drugs.

We have also done work in hexapod precision devices. Using Phase I and Phase II SBIR funding from NSF to design a new class of high-speed, high-precision machine tools based on a hexapod-configured device called the Stewart Platform, we then transferred the technology we developed to Ingersoll Milling Machines who took a variant of this machine to market.

We then extended our technology in hexapod systems to a new class of exercise and physical therapy machines. NASA has awarded us a Phase I and Phase II SBIR to use this hexapod technology for a new type of exercise equipment for astronauts on board the international space station. Our initial demonstration to NASA should take place within a few months, and we now are engaged in discussions with prospective home and health club exercise equipment manufacturers.

We also work in the area of Internet technology. Here we began developing personalized methods of using hyper-media to optimize learning outcomes. Our unique approach—this lead to our unique approach for Internet search and navigation tools.

Following SBIR-funded research, we developed a set of proprietary web tools and methods that has led us to build special-purpose web sites for government and commercial clients. Our technology uses an innovation we call the COOL link that personalizes each person's navigation through the web and is especially useful for web-based education and training applications.

We are developing web sites and associated Internet technology for clients such as American Airlines and the Census Monitoring Board. We are using the same technologies to develop web-based intelligent transportation system training programs for a regional consortium.

From these few examples you can see that the SBIR program has been very instrumental to our technological developments, our product development, our entry into the marketplace and our growth as a company. I know of other companies like mine that have benefited from this program; and these, in turn, benefit the

Nation with the result of their work. The program has already proven to be successful in achieving its goals of promoting innovation and scientific development, encouraging entrepreneurship and giving government agencies a high-quality return on their R&D funds.

Would I recommend reauthorization of the SBIR program? Of course. It is good for my company, it is good for the government agencies that participate, and it is good for the Nation. The success of the program to date speaks to its structural integrity so that significant changes to it are likely to be more damaging than helpful.

Would I like the amount of the overall program to be increased? Certainly I would. Would I like individual contract amounts to be increased? Certainly I would—especially for Phase I.

In closing, I would like to reiterate my strong support for the program. Two decades ago you may recall that America was falling behind the Japanese and European countries in a number of key technologies. Our competitiveness was in jeopardy. It was during this time period that the legislation initiating the SBIR program was first passed. I have no doubt that the SBIR program has played an important role in the resurgence of our Nation's technological prowess. Overall, the SBIR program is one that works for my firm and for many like it. My strongest suggestion is to reauthorize the program for the next 10 years of innovation in small businesses in America.

Thank you.

Chairman BARTLETT. Thank you very much.

[Dr. Haynes' statement may be found in the appendix.]

Chairman BARTLETT. Dr. Larson.

STATEMENT OF DR. ARVID LARSON, CO-CHAIRMAN, AAES R&D TASK FORCE

Dr. LARSON. Good morning, Mr. Chairman and member of the Subcommittee.

My name is Arv Larson, and I am also the owner of a small business, but I am here today representing the American Association of Engineering Societies. As you know, the AAES is a federation of engineering societies dedicated to advancing the knowledge, understanding and practice of engineering. Its member societies represent more than 1 million engineers who work and practice in the United States. Many of these are employed by small businesses.

I want to personally thank you for the opportunity to testify today in support of reauthorizing the SBIR program. I was quite privileged to be able to present my views in favor of this legislative initiative in 1982 when I testified during SBIR's first authorization hearing. In the intervening years, the SBIR program has found success far beyond what we initially envisioned. I am very pleased to see that those results of the efforts of the early SBIR advocates have proven beneficial. SBIR is now a thriving program providing essential assistance to small entrepreneurial companies. The demonstrated success of this program cannot be challenged.

Mr. Chairman, my personal experience with the SBIR program is extensive. I have been involved with the high-technology small business community in both California and Virginia, and I have seen the value of this program in action. I got involved with the

start-up of an entrepreneurial high-tech company in Sunnyvale, California. We were very fortunate in the 1980s to receive nearly a dozen SBIR Phase I and Phase II awards. From these we developed many products. We grew from a handful of entrepreneurs to an employment base of over 75 engineers and staff in a period of about 5 years.

More recently, while I was a research professor at George Mason University in nearby Fairfax, Virginia, I was also Director of the Small Business Programs. I was involved with over 100 small business high-technology companies in the Washington, D.C., area, many of these located in our small business incubator program.

I worked with many of these small businesses in their development of proposals to receive Federal agency support through the SBIR program. I saw how critical the Phase I and Phase II awards were to the continuation of their entrepreneurial spirit. The relatively small investments made by the Federal government through these SBIR program awards were often the key factor in attracting venture capital and achieving business success. Due primarily to these SBIR awards, several of these firms were able to attain the necessary critical mass of a viable product base and technical staff. The SBIR program allowed these firms to become thriving tax-paying businesses within the national capital area. You have two of them here at the table with me.

As you know, the SBIR program was originally enacted in 1982 to increase the participation of small high-technology businesses in the Federal research enterprise. You also know, of course, that, historically speaking, small businesses have provided greater innovation than larger companies. Unfortunately, these entrepreneurial businesses often did not have the resources to access the myriad number of research grant agencies within the Federal government. For more than 15 years, the SBIR program has successfully assisted these businesses through achieving the underlying goals of the program.

Mr. Chairman, I am pleased to report to you that, based on my personal experience and those of other small business entrepreneurs that I deal with, the SBIR program is consistently meeting the goals of the originators of this program. SBIR is contributing to technology innovation. Agencies are utilizing small business to meet many of their research needs. In addition, the fruits of this Federal research investment are being brought into the marketplace via small business.

The National Science Foundation has conducted studies of their own SBIR grant program. They have determined that since the inception of the program their investment of $350 million has accounted for nearly $2.7 billion in direct sales and more than 10,000 jobs created. That is a seven to one return on investment. As a taxpayer, I am very pleased to have the Federal government get that kind of return on investment.

Another special focus of the SBIR program has been to provide greater outreach to minority-owned small high-technology businesses, and I think also sitting here at the witness table are examples of that. Approximately 10 percent of all SBIR awards have consistently gone to minority-owned companies. It is clear that minority-owned businesses are actively participating in the program

and thus have unparalleled access to the Federal research establishment.

Technology transferred from Federal research into the marketplace under this program has been and continues to be effective. Ensuring that the fruits of Federal research are realized is vital to our economic well-being. The Small Business Administration estimates that over 30 percent of Phase II projects result in viable commercialized products or services.

I think the bottom line here, Mr. Chairman, that is that SBIR is indeed a successful Federal program. I know that you and your colleagues are as supportive of this program as I am. I look forward to seeing the SBIR continue to foster innovative technologies that will make the quality of life of all Americans better. Most importantly, SBIR will continue to strengthen our economy by providing critically necessary innovation to allow us to compete in the competitive world marketplace and also provide high-technology employment opportunities to all of our citizens.

Thank you, Mr. Chairman. I would be happy to answer any questions.

[Dr. Larson's statement may be found in the appendix.]

Chairman BARTLETT. Thank you all very much.

Let me now yield to Mr. Hill for any comments or questions that he may have.

Mr. RICK HILL. Well, thank you, Mr. Chairman; and I want to thank all the members of the panel for your testimony. It is very valuable.

Let me say from the outset I am a strong, enthusiastic supporter of this program. You will probably sense that in the questions.

One of the questions I have, however, is whether or not we have got in place sufficient tools to make sure that a sufficient proportion of awards are going into rural areas.

I represent a rural State, as you all know; and we are trying to build some infrastructure into the State of Montana to create the benefits and opportunities that come from technology and the transfer of technology. So I would just start—is it Behar?

Mr. BEHAR. Behar.

Mr. RICK HILL. Good guess, huh—and then just go across the panel. Is the outreach program enough? Is it sufficiently funded and are there other things that we should do, is my question.

Mr. BEHAR. Well, speaking from rural northern Virginia, I am not the right person to answer your question. I would commend any efforts to spread the SBIR program throughout the country. I don't believe that there is a monopoly on good ideas. But I confess, Mr. Hill, that I am not much of an expert on the topic, so I will yield to my colleagues.

Ms. ARMSTRONG. I have actually spent a fair amount of effort in mentoring other companies in the State of Colorado; and Colorado is perhaps an advantaged State because we have a lot of Federal activity there, a legacy of the Eisenhower presidency, so we are predisposed to success.

But I will tell you that the mentoring has been very successful at getting others involved. In my written testimony I talked about the level of effort that went in, and it was a group of volunteers, and we did it all with only $10,000. I would tell you that there are

mentoring things that could be done with a nationally funded program. I would also comment there is no better time to embark on such an effort with the Internet and the ability to communicate at long distance and virtually be beside each other.

Tek-Gear was placed in Jackson, Wyoming, because the lead technologist on Tek-Gear who productized it lived there; and the effort was to have Tek-Gear run out of Jackson. The impediment to doing that was Federal Express and the ability to get turnaround on a one-day basis in Jackson, Wyoming. So there are limits to what you can do in remote areas, but there is no reason that R&D can't be carried on in those areas. And mentoring and using the support of people who know how to use the program and are willing to share that expertise with those individuals would be one way to make it happen.

Mr. RICK HILL. I made note in your testimony about the issue of mentoring. Obviously, you are talking about other companies as well as university people.

Ms. ARMSTRONG. Absolutely.

Mr. RICK HILL. Do you think there should be some reference to that in the reauthorization and, if so—I mean, obviously, you are recommending some appropriation for that purpose. You think that would be an important part of helping us move towards more success in rural areas for SBIR?

Ms. ARMSTRONG. I absolutely think that would be critical, and I think it is a very right time for those dollars to make a significant difference.

Mr. RICK HILL. Thank you, Doctor.

Dr. Haynes.

Dr. JACQUELINE HAYNES. Well, my suggestions—well, first one comment that I have is that, to look at the impact of the SBIR program, you have to look down a level from the first-tier awards of Phase I and Phase II that are made to companies like mine. I mentioned that we have subcontractors and consultants in 11 other States. Over the course of our 13 years in business, I don't think we have had a subcontractor or consultant in Alaska or Hawaii, but I think we probably have in almost every other State, including Montana; and I think that is an important feature of small businesses and their need to network and partner with a whole lot of expertise in areas that is outside that of their own immediate staff.

Secondly, I think that a mentoring program is a superb opportunity for SBIR companies like mine who have been successful to work with other companies, with other individuals who are even considering starting companies to kind of bring them into this way of doing business.

For very small companies there is a financial burden to them that they can't really afford to do without some appropriation for that that covers at least the direct expense part of that kind of program.

And the third thing that I would suggest is that there is—a lot of the difficulty, a lot of the impediment to a start-up business in becoming a Federal contractor is just knowing how to go about doing that. If you are in a rural area, it is maybe not so easy to call up your local DCAA audit office that is only a few miles away and tell them that you would like to come over because you don't

know if what you are doing is the right way to do it or not, and you would like some help to make sure that it is, and if you are in a rural area perhaps it is not so easy to do that.

But using the Internet you could build a lot of infrastructure that would make a lot of that kind of support help available nationwide to anyone who wanted to participate, who wanted to find out what does an acceptable time sheet look like, what do I need to do for some of these other kinds of things.

Mr. RICK HILL. Are you familiar with the outreach program that we—I think the change we made I think in the last Congress and we funded? Should the mentoring program in your judgment be made part of that or should it be—the genesis of that coming from the agencies that are contracting for research? Where do you think the genesis for that should come?

Dr. JACQUELINE HAYNES. I think it should come from the agencies themselves. My experience is that some of the focus on the kind of university and universities mentoring small businesses isn't always real successful. They don't—the academics don't always kind of get it, what it is like to be in the marketplace.

Mr. RICK HILL. Thank you.

Dr. Larson.

Dr. LARSON. Well, I have to say that most of my personal experience comes from the rural areas of Santa Clara County, California, and Fairfax, Virginia. But I have also had the opportunity to participate in the small business community of the national level, and I know that most States have some form of a program to outreach to the small business community in various ways, often through the State university systems and incubators and various other endeavors at the local or State level.

Outreach by the agencies is possible. I think what my colleagues have said on the panel is true—there are many impediments. The further away you get from large metropolitan areas and large State universities, the more difficult it is to deal with this. But I think mentoring programs do exist.

I participated in a number of small business conference days around the country speaking on the SBIR and other opportunities such as the advanced technology programs with the Department of Commerce, which has a similar sort of outreach problem. There are many States and many congressional offices that have sponsored these outreach programs and special activities.

I would like to say I also agree it should be done at the agency level. I think each program and each agency is sufficiently different that the special needs of the agency for specific research that they need should be accommodated.

Mr. RICK HILL. Thank you. Thank you all very much.

Thank you, Mr. Chairman.

Chairman BARTLETT. Thank you very much.

This hearing is very meaningful to me personally. I didn't hold a prior political office. I didn't even run for this office until I was 65 years old. So I obviously had a prior life. I have a Ph.D. in science. I have 20 patents. I started and ran a small business. And where was SBIR when I needed them back in the 1960s? It would have been very helpful.

The first question I had—and one of the nice things about letting others go first is that you have fewer questions to ask. The first general question I had to ask was about national mentoring as mentioned by Dr. Armstrong. And we have some rural areas in our district, three counties in Appalachia, that desperately need more input of this kind of capital. Since small business is more creative than large business, since most of our patents come from small businesses, clearly it is in our national security and in our national economic interest to encourage the kinds of programs that SBIR fosters. And so my first general question was going to be, how can we get the word out?

I suspect that there are many, many entrepreneurs that don't even know that this program exists and don't know that there is this opportunity, and I think that that is a double loss. It is a loss to all of those entrepreneurs who can more quickly develop their businesses if they knew of this source of funding, and it is a major loss to our country because we are now denied the products and services that could be more quickly available or maybe they wouldn't be available at all to us without this source of capital. And how can we get this word out more broadly?

You know, I don't know if there has been any surveys about how many small businesses in the technical areas even know that this program exists. I would suspect that it is not a big percentage that even know the program exists. How do we get the word out?

You mentioned the agency should be involved. They are very comfortable working with the people they contract with already. It is tough to get these people to add new contractors because they are comfortable with the people they are working with. What role could the Small Business Administration play in this?

Ms. ARMSTRONG. I would comment that two things that created success in Colorado when we have held events and they have been sponsored by various entities, Representative Skaggs sponsored some, SBA has sponsored some, those people that are most well attended—there are two groups to which people are attracted. One of those groups is other winners. They love to hear success stories. So we need to get some mobility in terms of getting those stories out to everyone. Because if you hear someone who has done it, it makes it—it invigorates you to try even harder or exposes you to something you haven't heard of before. The two videotapes we created were disseminated widely in Colorado, and I think made a difference in the participation level throughout the state.

The second group of people that are very attractive speakers are people from the venture capital or the monied community. People will always go to see someone like that speak in an effort to think, well, if I just had this money, I could get it here. So they are another group to involve in an outreach effort because they represent another source of capital, and perhaps they could be brought in to help with the process of getting the message out.

And I would also comment that big business doesn't get it quite yet, and they could have a role to play in an outreach function as well if we can have them be better informed.

Chairman BARTLETT. Of course, our legislation requires that a certain percentage of this money go to this program, and much of

that money goes through big business and to subcontractors. So there is an incentive there.

Mr. Behar.

Mr. BEHAR. Mr. Chairman, I would like to second some of the thoughts that have been aired by my colleagues here and add to them. I am aware that the SBIR program has gone now on a "road show," if I may say, providing sessions about the SBIR program and encouraging people to come to those. I would encourage NIH to expand the "road show" as widely as possible and, of course, in rural areas where we would like to see more energy going to.

The other one is probably the most obvious one, the Internet. I mean, we are all converts to the Internet. Every time I seek out government information I am, quite frankly, very impressed by the abundance of information on government programs on the Internet, and there is similarly high-quality information about the SBIR program.

However, I think it can be spiced up by some of the ideas that Judith suggested earlier about success stories and have maybe some of us be involved in adding to these Internet sites so as to give us an opportunity to talk in the entrepreneur's language. I think the Internet is almost an ideal tool to bridge that gap of knowledge and of geography.

I wanted to make a point here to Mr. Hill's earlier question that is somewhat relevant to this issue. Last Friday, my top-notch computer guy closed the door, and my heart sank. You know, any entrepreneur is aware of the feeling when you are very dependent on a person what happens on a Friday when they close the door. And, indeed, he told me that he and his wife had decided to move out to a rural area. So I must confess that upon hearing this thing and his commitment to stick with the company and its missions and only to want to have a change of venue, I was so very grateful. And, in fact, it is our contribution, if you want, to spicing up the rural areas with the seeds of entrepreneurship.

There are two words to my morals. One is that we can spread the knowledge along the line of mentoring, as was said before, but the reality right now is that it is really not sinking in fast enough. Second, that the Internet has created a new world, one where, you know, virtual businesses can exist, where geography is not that important, and that we need to both foster it and use it in order to deal with issues like the one you brought up, gaps of information, gaps of geography, et cetera.

Chairman BARTLETT. Dr. Haynes.

Dr. JACQUELINE HAYNES. In speaking to some other small businesses who don't participate in the SBIR program, one of the things that I have come across frequently is their misunderstanding of a key feature of the SBIR program. They have said that they don't participate because they don't want the government to own the technology that they develop, and they don't understand that one of the key features of the SBIR program is that the rights to the technology remain with the company that develops it.

And I think that a better information campaign along with better—information campaign about the program in general should be very specific about that point and should—I think that there is

some element of the small business community that is not participating in this program for the wrong reason.

Chairman BARTLETT. Is that information not obvious on the web site?

Dr. JACQUELINE HAYNES. It appears obvious to me, but when you talk to people who perhaps have not gotten that piece of information, have not looked at the web site, have heard about it, maybe they haven't heard specifically about the SBIR program but their understanding is if you do any business with the government, the government owns everything. And they don't understand that this program is different, is very different in that respect.

Chairman BARTLETT. Historically, for government programs—and I worked in the past on a lot of government programs in a lot of different venues—the government did everything. Nineteen of my 20 patents are government patents. But they had the wisdom then to at least give the inventor commercial rights. The government kept what is called shop rights. They could use the invention for any government purpose, not just the agency that helped you patent it, but any other government agency could use it. But in the commercial world the inventor had the commercial rights.

Now if that hadn't been the case, I wouldn't have had one Federal patent because I would have had zero incentive to do that. And, you know, nobody other than the inventor is going to take the initiative to get the thing patented. My supervisor didn't know enough about it or have an interest or anything to get the thing patented. So this really was a very farsighted position on the part of the government that I worked in. I worked with the Defense Department, and 19 of my 20 patents are Navy patents.

But there is this general perception that if you work for the government you don't have any rights. They take them all. So this is important. I guess we need to underscore that and put asterisks around it so that it is highlighted.

Dr. Larson.

Dr. LARSON. Well, Mr. Chairman, I would like to second the remarks of all my colleagues here.

In response to your question on how we can improve the outreach and the information transfer, I think the present programs that exist within a number of entities who are involved in this program on the Federal side, the State side, and the academic side, are very effective. I think there are a portion of people who will not participate in government programs—who don't want to hear how this program works—but I haven't really run into many of those. Once they understand the program, the information available is pretty effective.

I think this information is available readily working through the various government agencies that have SBIR programs, and with the road shows that the SBA, many State governments, many State universities and, as I said earlier, the congressional offices have. I work with my own Congressman, Jim Moran, in his outreach to the small business community in northern Virginia, and we really have large crowds.

They do like to hear success stories. They do like to hear how to do it. They want practical information. They don't want to spend a lot of time learning about another government program. But this

is kind of a win-win situation. Most people when they do learn about SBIR are quite pleased with the way it can be used to the benefit of everyone.

Chairman BARTLETT. My particular interest, like Mr. Hill's, is rural areas. The second largest county geographically in Maryland is Garrett County. It has 28,000 people, and we have double digit unemployment. And there are a number of entrepreneurs there. And I am just not sure that in the more urban areas and suburban areas the communication lines are a whole lot more effective than in the rural areas that Mr. Hill and I represent. He is the only representative from Montana. That is a big district. My district is the biggest one in Maryland, but it is very small compared to his district.

Yes, Dr. Larson.

Dr. LARSON. Well, Mr. Chairman, I am sure you work with the University of Maryland and their outreach program. I know they concentrate more on Baltimore and the urban Washington-area counties than possibly on rural Maryland.

Chairman BARTLETT. Well, we have Frostburg, which is a part of the university system, Frostburg State University. They do a good job. And we would like to see how the job can be done better.

Dr. LARSON. My experience in Virginia is with the Center of Innovative Technology. At the State level our administration has provided outreach to southwest Virginia, which is equally in Appalachia and has the same demographic characteristics as your counties. And I think it is fairly effective. They have a "bridge" program, as it is called, that tries to couple the high-tech community in northern Virginia into southwest Virginia and build up partnerships with entrepreneurs in both areas. It seems to work.

I think it varies from State to State, but every State I know of has some sort of outreach program.

Chairman BARTLETT. Mr. Hill, do you have a comment or question?

Mr. RICK HILL. I never hesitate to swap stories when we talk about the size of my district. I have some counties there are larger than the State of Maryland with fewer than a thousand people in them. We are struggling just to make sure that they have access to the Internet. So there are some interesting challenges.

If I could ask just one additional question, Mr. Chairman, one of the things I noticed working with companies that have had SBIR contracts, I think, Dr. Haynes, you talked about your company as a think-tank company. You created a company with that purpose. One of the things we seem to have some difficult is getting the technology licensed into a successful entity in our State. We want the spin-off jobs as well, potential. And the question I would ask would be two things.

One, is there any barrier that exists now in the way agencies award these projects that create some sort of a barrier to commercialization or in any way? And if we could identify that. And then the next, are there any elements of this that would create a barrier to access to venture capital, would be the other question that I would ask. And then I guess the next question is, is it realistic to expect that the people who are contracting, doing SBIR projects,

really do want to run commercial entities or really are they more interested in just doing research?

If it would be possible for any one of you to address those three questions.

Dr. JACQUELINE HAYNES. Let me start. Just in answer to your question—let me start with your last question first.

Mr. RICK HILL. All right. Any order.

Dr. JACQUELINE HAYNES. I think a company, an entrepreneurial company wants to have the commercial opportunities that the technology that they develop affords, if for no other reason than strictly for financial reasons. There are far greater profits than there are in the maybe 6.5 or 7 percent that maybe you can squeeze out of governmental R&D contract. So there is certainly a strong financial incentive for doing that.

On the other hand, when you have a company with a group of people whose primary culture is science, research, engineering, theory, those kinds of things, they don't—those people don't suddenly complete a project and become businessmen and women. They do what they do.

So what you need is a company that can then grow to accommodate the commercial side of your business while you maintain this robust R&D environment. And having both of those things going on simultaneously in the business—in the size business that our company is evolving into now is a very exciting thing, very challenging. Because the concerns of R&D and science and the concerns of entrepreneurship and business, commercialization are related but not the same.

That is one of the reasons that part of our approach has been to team with big companies that do the marketing, that—I mean, their expertise, where their forte is, is not in the R&D. It is on the commercial side. And those partnerships have been very successful for us maintaining kind of our core business for what we are good at doing, partnering with other people who are really good at what they are doing, and all of us benefiting from that kind of expertise. That is kind of how it has worked out best for us, I guess.

He talked about access to venture capital. I think the program as it is provides—does not provide a disincentive to venture capitalists when venture capitalists understand what the program is. And there again, just as an example, one of our products in the educational area we took to a major educational publisher in New York, and we talked to them about it. And their first reaction was, we don't do anything with the government. We don't have any relationship with the Federal government. We don't want to have any relationship with the Federal government. We are not interested in a project that involves anything to do with the Federal government.

They clearly didn't understand the nature of the program, that Federal government doesn't have their hands in the product. They were kind enough to support their research and wise enough to support their research, but the product is a spin-off from that and independent. It is very difficult to convince people of that at times.

Mr. RICK HILL. Thank you. Thank you, Mr. Chairman, also for indulging me on another question. Thank you very much.

Chairman BARTLETT. Thank you very much. Hearings like this are a pleasure. Frequently our hearings are looking at programs

that have major problems. There have been two GAO reviews of this program. Both of them have been very positive reviews.

I wanted to turn for just a moment to your recommendations, which is a prime reason for our hearings. I have jotted down the recommendations as I read your testimony and as you talked.

Dr. Behar recommended that we increase the funding for Phase I; and that was also repeated by Dr. Haynes, that we could probably use more funding in Phase I. Now one of you noted that in some of the particularly complicated high-tech areas that more funding was needed, but it wasn't true across the board. We may need help in crafting language—what we don't want to do is set up a program where everybody automatically gets $175,000 for Phase I. We would like the award to be commensurate with the challenge. So we may need help in doing that. The $750,000 for Phase II is adequate. Nobody questioned that.

The 2.5 percent, the overall amount of money in the program, at least one of you mentioned you would like to see more money. I would like to see as much money as can be profitably used. I worked for big business, I worked for IBM, I worked for the government, I worked for universities, and I will tell you, you get more mileage for your dollar in universities. That is because you have slave labor there. Those of us who have Ph.D.s understand that.

The next, small business, I think you get better payoff on your dollar invested than you do in big business. So I have no problem in supporting increasing, if it could be profitably used, the 2.5 percent. I just think that the Federal government—and the taxpayer, ultimately, because it is the taxpayer's money will get better mileage for that. All of you who made recommendations suggested that we extend it for another 10 years, and that if it ain't broke, don't fix it.

Dr. Armstrong said that we didn't need any changes in the program, and I think that changing just for the sake of change could be counterproductive. I think it was Dr. Larson who mentioned that it could be counterproductive doing that.

Dr. Behar, you market an aid to help people stop smoking.

Mr. BEHAR. That is correct, sir.

Chairman BARTLETT. I wonder how often you have thought about some of the inconsistencies in our society. The taxpayers help you develop the technology for that device through an SBIR contract. Those same taxpayers through government programs support the growth of tobacco. And that those same taxpayers, through their elected representatives, permit the tobacco industry to advertise, enticing more and more of our young people to begin smoking. I know that the more people who smoke, the bigger your business grows; but I suspect that you wish that you had fewer demands for your product. How do we, as a society, deal with this?

Mr. BEHAR. Well, Mr. Chairman, this irony is one that I have lived with for the last 16 years. Coming from the beautiful State of Virginia, one that is known for a great deal of things including the lowest tax on cigarettes of any State and a State that has committed minimal funds for tobacco control, I am especially or acutely aware of this big contradiction.

As to the solutions, let me first allay any fears that we are going out of business. As I indicated in my testimony, when I got first

in the business in 1994 there were 50 million people who smoked and there are still 50 million people now. I recently read a research that unless something really dramatically happens—and nobody anticipates it—it is expected to be so until the year 2030. So I don't think any of our shareholders have got to be very fearful of our business going away.

The flip side of this is what do we do as a society to control this. The reality is this: About 6,000 kids attempt smoking each and every day; 3,000 of them get hooked; and about 1,000 of them, as we know, are likely to die from a smoking-related disease. This is what is fueling the problem.

Now, unless we find the means of dealing with this issue, we will forever have this 50 million problem to deal with; and I am very pleased that one of the SBIR-funded grants has produced a product which is a program that is designed especially for kids.

One of the issues that pertain to smoking and kids is that, unlike the world of adults, where there is a plethora of products—I mean the nicotine gums and patches and what have you. There is nothing like that for kids. In fact those products are not allowed to be used by kids. And so, consequently, when kids try to quit—and it is a myth that they don't. Most of us adults think that kids think that they will live forever, and they don't try to quit. The fact is that about 70 percent of them try to quit and try to quit repeatedly. And when they do so, they quit smoking cold turkey. Cold turkey didn't work for adults, and it is not going to work for kids.

So the answer lies here in redoubling our efforts in finding effective means to deal with prevention and to deal with cessation, and I am very proud of fact that my company is engaged in both of them.

Mr. Chairman, I can speak in great lengths about this topic, but I would not like to monopolize this issue here, and will yield to my colleagues.

Chairman BARTLETT. Well, thank you very much.

I carry a copy of the Constitution. I am very much aware of the enormous safeguards that are assured us in the amendments, particularly the first 10 amendments, the Bill of Rights. But I would tell you our forefathers never envisioned that you would have unbridled expression of those rights. You cannot yell "fire, fire" in a crowded theater. You ought to be able to do that under the first amendment right of free speech. But everybody understands that you can't yell "fire, fire" in a crowded theater if there isn't any fire because people may get hurt in their rush to the door.

Let me use that same logic, if I can't yell "fire, fire" in a crowded theater because I may get hurt trying to get out, then you can't advertise cigarettes to my children because they are going to get hurt if they smoke cigarettes. Now, I don't think that is censorship. I think that is sanity. But we are not there yet. Thank you very much.

Dr. Armstrong, you mentioned that in your testimony, written testimony, that you do some work with power stack scrubbers. Is this physical equipment or software equipment?

Ms. ARMSTRONG. ADA is a very hands-on company, and we work with full-scale equipment in power plants around the country constantly testing and prototyping technology on slipstreams from

those power plants. So we have hundreds of thousands of dollars worth of equipment that we ship around the United States that do testing. So we have people and we have equipment deployed in many locations. The technology that we spun out was a flue gas conditioning technology where we injected a spray into the stack to change the properties of the stack gas. So it is real, physical, hand-on technology.

Chairman BARTLETT. You change the properties so that they are more easily scrubbed?

Ms. ARMSTRONG. We changed the physical property of the ash so it is more easily collected by the APC collection devices.

Chairman BARTLETT. That is what I mean by scrubbing. The device that you held in your hand, the Trekker, is that how you pronounce it? The Trekker device, this does what?

Ms. ARMSTRONG. It is a datalogger for high school science. It is very simple to use. It will get students accustomed to using instrumentation to do science, as opposed to using a pencil and paper and writing things down. It can connect to a computer MacIntosh or PC, and they can learn to use spreadsheets to look at the quality of the data. So it is really an education tool to teach students in the high school, and we are moving it toward the middle school, the skills that they need to have for the next generation of jobs.

Chairman BARTLETT. You mentioned also that you were developing science games.

Ms. ARMSTRONG. Um-hmm.

Chairman BARTLETT. That might compete with the violent games that are being sold to our young people.

Ms. ARMSTRONG. That is very true. We have some funding from NIH, and we are developing—and this is the entrepreneurship piece—we have people who are developing those for educational purposes, for the life sciences, to be used in the schools. The particular individuals doing it have developed successfully commercial games. So at night they are taking what we are doing for NIH and they are working to see if they can convert it into a commercial game which will be to their personal benefit.

Chairman BARTLETT. I wish you all the luck with that.

The industry that tells us that all the filth and violence that they immerse our kids in doesn't affect the kids. It is the same industry that tells the people who advertise on them that the public is really going to be moved and changed by their advertising.

Now they can't have it both ways. Either the advertising does no good at all or, if it does what they claim it does for the people who pay them for advertising, then our kids are affected by the filth and violence that they see. So, you know, good luck with those games.

Ms. ARMSTRONG. Thank you very much.

I will comment, my son graduated from Columbine High School, so I appreciate your comments.

Chairman BARTLETT. That was my first comment when asked by a reporter, did I have any thoughts of that? Yes, were you surprised? Our kids are immersed in a sea of filth and violence and what those two boys acted out is what all of our kids see a dozen times a day on television and movies and in their video games.

You know, the Bible says, by beholding you become changed. And if our industry didn't believe that, they wouldn't be able to sell advertising. If they didn't believe that the listeners by beholding their advertising are going to be changed in their buying habits, they wouldn't be able to sell any advertising, would they?

You know, as I said before, this isn't censorship, this is sanity; and I don't know how we get there because we aren't there yet.

Dr. Haynes, I noted that you noted that you have employees from Taneytown and Frederick. Our people have a good work ethic. I am sure that they are some of your better employees.

Dr. JACQUELINE HAYNES. They definitely are.

Chairman BARTLETT. I was intrigued by your impulse radio that doesn't need the frequencies which are becoming crowded. And we have a necessary intrusion of government into this industry because we have to share limited air waves. Just very briefly, how does impulse radio work?

Dr. JACQUELINE HAYNES. Well, that is not part of my area of technical expertise, but my husband is here, and that is part of his technical area of expertise. So perhaps he can answer that question.

Chairman BARTLETT. I would be pleased.

Dr. LEONARD HAYNES. Thank you, Mr. Chairman.

Impulse radio was developed by a company called Time Domain Corporation in Huntsville, Alabama. They have a number of patents. There has been a number of interests in other companies that have started working in that area. Lawrence Livermore Laboratory has also done work in that area. We became tied up with Time Domain Corporation via the SBIR program where we had proposed to use that technology in some projects for the Army and the Air Force. Those projects have gone along extremely well.

Now, to answer your specific question, most radio trans—all radio transmission to date has been waves. We all hear radio waves. A radio wave is a continuous thing.

Impulse radio no longer uses waves, it just uses impulses. It is a pulse and then a little later a pulse and then, later than that, a pulse. And if you create these pulses in the right way, they can transmit information. So you are no longer transmitting waves, you are just transmitting impulses.

If you say, well, what frequency is being transmitted, the best answer, without going into a lot of technical detail, is all frequencies simultaneously are being transmitted. And if you say, well, how did that work? Again, without going into great detail, because we can now build clocks, electronic clocks that are so very accurate down to picoseconds, 10 to the minus 12 seconds, you can now find these pulses in what is generally just noise.

The technology is quite outstanding in its potential. For example, a typical cell phone like I have here has about a half hour of transmit time; and it is because when it is on and transmitting there is continuous energy being transmitted, continuous waves. A cell phone made of impulse radio would have a typical transmit time of 500 hours. Why? Because it transmits this short pulse, and then it doesn't transmit anything for a long time. Then it transmits another pulse. By a long time, we mean a few microseconds that between pulses that are a nanosecond wide.

Chairman BARTLETT. It is like a strobe as compared to an ordinary floodlight.

Dr. LEONARD HAYNES. You can think of it that way, yeah. If you had a strobe light sending out flashes and you sent them out in a sequence and if you knew exactly when to look for the strobe, even if it was a bright sunny day, if you knew exactly when to look, you would be able to distinguish the strobes.

And there is a very touchy issue with the FAA and the FCC who are denying the request to be able to produce these kind of radios because, in theory, they transmit at all frequencies. So the first question is, well, do they disturb anyone else? The answer is no. In fact, we have done tests where we take a hair dryer and the energy out of the hair dryer is 20 times the energy out of these pulses. But yet the FCC says, well, the hair dryer is accidentally transmitting this radiation, your radios are intentionally transmitting them, so we are not going to authorize you. And that doesn't really make sense.

Next criticism is, well, if there were thousands of these radios, maybe it would start interfering with things. Well, if you say—Time Domain did an experiment where they put their transmitter right in the same box as a GPS receiver, which is about the most sensitive electronics, they operate at very low signal-to-noise ratios. And it didn't hurt the GPS receiver at all even though the transmitter, this impulse transmitter, was right in the same box. So, anyway, over the next few years we will see—you can't deny progress. You can't have laws that are contradictory to the realities of physics and the need for more spectrum, and there will be more concern over this.

I have just finished a proposal to the National Science Foundation to look at the basic mathematics of this. Because even the current mathematics are not adequate to deal with impulse radio. What is the furia transform of a pulse? Well, it is all frequencies. But the furia transform says they last for minus infinity to plus infinity in time.

Now we know that is not true. A pulse now, not going to still see the effect of it a week from now. I mean, it doesn't even make sense. But yet that is the way—the traditional ways to deal with radios and frequencies and things like that mathematics is based on that.

Anyway, that is—I hope that is not too much of an answer.

Chairman BARTLETT. No, no, it is not too much. I come from a science background, and I appreciate it.

We have a number of lights on the board. We will find out what they mean. Because my beeper hasn't gone off. It means we are in recess.

Nature has been exploiting a similar capability of this for a long time. A bat, for instance, in a forest of a million twittering leaves can single out, with its echo ranging, a single insect and hone in on it to catch it. And a porpoise, by echo location in the water, can differentiate between a fake ham and a real ham simply by feeling it with this echo ranging. So these are all pulse kinds of things that nature has been exploiting, and this is an exciting new technology that we will watch with interest.

Dr. Larson, I noted with much interest that you were here at the beginning, you testified, in 1982 when the program started; and I think in your written testimony you said that it has exceeded your fondest expectations.

Dr. LARSON. Yes. I worked with Roland Tibbetts from the National Science Foundation and Congressman Bedell and Senator Rudman in the early 1980s to help create this program.

Chairman BARTLETT. You also mentioned NSF reviews of their program which showed 11 successful returns. Have other agencies done similar reviews? Or do we have only the GAO reports as an overall assessment of these?

Dr. LARSON. The various GAO reports do look at it agency by agency. I am not aware of other agencies that have done this, although they certainly may exist.

Chairman BARTLETT. Well, I want to thank all of you very much for your testimony and your contribution, and we are just happy that this hearing can focus on positive things, that we only need to do a few things to improve the program, that we didn't have any major glitches that we have to correct. Let me thank this panel and ask the next panel if they will take their places at the table. Thank you very much.

We will welcome our second panel, Dr. Busch from Montana and Mr. Daniel Hill, Assistant Administrator, Small Business Administration. We will have a chance with this panel to focus in more detail on some of the concerns that were raised in our first panel that is about how do we involve more rural America in this program.

Welcome and thank you for coming to our hearing.

We will hear now from Dr. Busch.

STATEMENT OF MR. CHRIS W. BUSCH, RONAN, MONTANA

Mr. BUSCH. Thank you, Mr. Chairman. Thank you for the opportunity to testify at this hearing about the SBIR program. I have strong convictions about its merits based on my experience with it as a small business person and currently as an agent of SBIR outreach in the northern Rocky Mountain States, primarily Montana and Wyoming.

My SBIR outreach work aims to help small businesses with all aspects of the SBIR competition process. The SBIR program is highly competitive, and I believe this is a key factor in the success of the program. We must protect this characteristic as we go forward.

Rural States have a special need for the technology-based businesses enabled by the SBIR program. These businesses provide for future economic growth, offer high-quality job opportunities for young people and university graduates and help retain intellectual resources within these States. Indeed, this process is already working in Montana and Wyoming and other rural States through SBIR program awards.

Historically, rural State small businesses have not fared well in the SBIR competition process. I believe we need to do a better job of promoting the SBIR program in these States. It continues to surprise me how many high-quality candidate businesses we find who have not yet heard about the SBIR program opportunity. Effective

SBIR outreach will engage these businesses and break down real barriers to SBIR competition in rural States.

During the past 3 years, I have participated in an aggressive and exciting SBIR outreach program in Wyoming called the Wyoming SBIR Initiative. Our activities include workshops, one on one monitoring, written communications, networking opportunities and a so-called Phase 0 program to help enable successful competition.

We are very pleased and proud of the results obtained with the Wyoming SBIR Initiative. The number of annual Phase I awards has increased from three in 1995 to five in 1997 to 11 so far in calendar year 1999. We believe this is conclusive evidence that effective SBIR outreach does work. But there is much more work to be done in Wyoming, and our outreach work must continue. A similar program is getting under way in Montana, where we will focus our energies on a highly effective SBIR outreach program.

The SBA Office of Technology, under the leadership of Dan Hill, presently is implementing an SBIR outreach program for States that underperform in the SBIR competition. I believe it is very important that the SBA outreach program be continued and that the funding for it be increased.

Federal SBIR agency personnel are vital partners in effective SBIR outreach. Examples of key activities include participation in SBIR conferences and workshops, site visits to SBIR winner facilities and commercialization assistance.

We must ensure that Federal agency representatives have necessary resources to adequately support effective SBIR outreach.

At the National Science Foundation, the EPSCoR program office provides funding for high-quality SBIR proposals from EPSCoR States that fall below the so-called pay line that the NSF SBIR program provides. In this way, high-quality proposals from these States are funded that otherwise would not be. This gives small businesses from these States a second chance to win and helps them over the initial barrier of capturing their first SBIR award. I suggest that other agency SBIR programs consider an initiative similar to this.

I would like to offer five recommendations for your consideration.

First, give highest priority to reauthorization in this session of Congress of the SBIR program essentially as it exists.

Second, continue and expand the SBA SBIR outreach program. I believe it is very important to keep this program competitive to ensure that effective SBIR outreach is provided as a result.

Third, allocate a portion of the SBIR program funds at each of the 10 participating agencies for SBIR outreach and assistance. A major part of these resources should be used in underperforming States, including rural States.

Fourth, I encourage that the mechanism used by NSF to fund the high-quality proposal from underperforming States be considered by other agencies.

And, finally, I think it important to establish a uniform and consistent method for agencies to calculate their extramural budget in determining their SBIR allocations.

Thank you very much.

[Mr. Busch's statement may be found in the appendix.]

Chairman BARTLETT. Thank you very much.

Mr. Hill.

STATEMENT OF MR. DANIEL HILL, ASSISTANT ADMINISTRATOR, OFFICE OF TECHNOLOGY, SMALL BUSINESS ADMINISTRATION

Mr. DANIEL HILL. Thank you, Mr. Chairman. It is a pleasure and an honor to appear again before you on this very valuable program. I am happy to be here, and good morning. And it is good to see Congressman Hill again. We were just in Montana together recently on an SBIR outreach program.

Thank you for inviting me to appear before you today to discuss the U.S. Small Businesses Administration's Small Business Innovation Research program, otherwise knows as SBIR. My name is Daniel Hill, and I am the Assistant Administrator for the Office of Technology at the SBA.

The SBIR program was created in 1982 with the following objectives in mind: to strengthen the role of the small, innovative firms in federally funded research and development and to utilize Federal research and development as a base for technological innovation to meet agency needs and to contribute to the growth and the strength of the Nation's economy.

Recent data from the National Science Foundation provide evidence that the small business role in innovation and the economy is likely to increase in the future. As we know, our economy is increasingly knowledge-based, where future competitiveness is determined by the quality of the human resource base of technically trained and skilled personnel. NSF data show that the human resource base, the technical intellectual capital needed for future innovation, appears to be moving from large business to small business.

A recent NSF study concludes, and I quote, "the employment of full-time equivalent research and development scientists and engineers rose almost twice as fast between 1995 and 1996 at small companies as at larger ones, 18 percent versus 10 percent, according to a 1997 national survey of R&D-performing firms." End of quote.

This data show the trend continuing from 1997 to 1998 with a 14 percent increase for small firms and only a 6 percent change for larger firms.

Another NSF study shows that as many recent college graduates with degrees in science or engineering are entering small firms as are entering large firms and that this amount far exceeds the number going into other institutions such as universities, non-profits, or government. These data show that the SBIR program helps the Federal procurement process focus on a sector of the economy with a growing innovation capacity.

The 10 Federal agencies in the SBIR program have very different research and development needs. Some seek the development of new products or processes to meet their program needs. Others focus more on building the research and science base in specific fields. The SBIR program has resulted in high-quality research and development for these agencies. The flexibility in the program design has enabled agencies to manage their programs to effectively meet their mission objectives.

Most evaluations of the SBIR program to date have focused on the success of participating firms in commercializing the results of their R&D. For example, a 1992 study by the General Accounting Office found that the program is showing success in Phase III—commercialization activity—and that SBIR expenditures of $956 million over the period 1984 to 1987 had generated $471 million in sales of new commercial products and $646 million in additional development funding as of July, 1991.

Studies by the Department of Defense and the SBA, using the same methodology as the GAO and applying it to all SBIR agencies, found that the average Phase II SBIR project over the period 1984 to 1993—funded at an average of about $500,000—had generated $955,000 in sales and attracted about $625,000 in additional, non-SBIR funding as of 1998.

A Harvard University study found that SBIR awardees grew significantly faster—whether measured by sales or employment—than a matched set of firms over a 10-year period. This study found this to be true in geographical areas that had existing considerable venture capital activity.

These analysts are quick to point out that any commercial success attributed to these projects adds value to the economy over and above the research they performed for the agency.

By making R&D funds available to small innovative firms, the SBIR program takes advantage of an underutilized economic and social resource—the small, flexible, innovative firm. Such a firm is willing to take the risk needed to transform a new idea into an innovation and to take that idea from the drawing board to the marketplace.

Studies and anecdotal evidence tell us that small firms have a number of advantages over large firms when it comes to innovations, such as greater flexibility, closer contact with customers and potential end-users, and a greater willingness to engage in high-risk R&D projects. These qualities have made small firms the leaders in industrial innovation, producing more innovations per employee and per dollar spent on R&D than larger firms. In fact, large corporations in innovation-intensive industries try to achieve some of the advantages of small firm organization through new business models using semi-autonomous research and business units.

Further evidence of the advantage of small innovative firms is the important role being played by small start-up businesses in the development of emerging high-tech industries such as biotechnology and information technologies.

But the many advantages and efficiencies of small innovative firms are not fully realized in our economy because of the obstacles they naturally face in raising capital.

Capital markets do not have the information needed to make sufficient investments in the high quality but risky small firm products that could lead to significant and socially beneficial innovations. The SBIR program funds those types of projects by providing high-risk patient capital that is not otherwise available in the market.

The impact of the SBIR program goes well beyond the outcomes of new product innovation and firm growth. At a recent symposium

conducted by the National Academy of Sciences Board on Science, Technology and Economic Policy, a team of researchers reported their findings from extensive case studies of SBIR recipients. At the day-long conference, the researchers reported finding a number of examples of start-up firms that said they would not have started their company at all if it had not been for the SBIR program. In one study it was reported that fully half of the firms surveyed said the existence of the SBIR program influenced their decision to start the company.

In addition, a study has found that SBIR start-up firms have had the effect of encouraging colleagues to seek funding to start other firms. One-third of the firms in one case study said their SBIR experience had encouraged their colleagues to form their own innovation-oriented firms.

There are other indirect benefits of the SBIR program to the recipient firms. These indirect benefits include increasing staff skills, retaining or hiring valuable researchers, increasing the credibility and financial stability of the firm, enabling new collaborative arrangements with others and influencing other R&D activities of the firm.

In summary, the SBIR program is working; and it is working well. It is achieving its congressionally mandated goals.

I would like to, for the record, also state that a large part of the SBIR's program success is clearly due to the skill, dedication and ingenuity of the program managers and the other Federal and State officials administering the program. It has been my pleasure to work with these officials. They are some of the best and brightest officials working in the government.

Many of them are here today; and, with your indulgence, Mr. Chairman, I would like to recognize them publicly and thank them on behalf of the administration. We have with us today—if they would just stand and remain standing until I finish—Jon Baron from the Department of Defense, who happens to be accompanied and supported by his Mom today; Joanne Goodnight from the National Institutes of Health; Teresa Perez from the Department of Defense; Carl Ray from NASA; Bob Norwood from NASA; Dr. Charles Cleveland from the Department of Agriculture; Dr. Kesh Narayanan from the National Science Foundation; Ritchie Coryell from the National Science Foundation. And we are very fortunate. We have two alumni: Sonny Kreitman, formerly with NIH; and Carl Nelson, formerly with DOD.

Mr. Chairman, these are the very best career civil servants you find in the government; and they are the ones who make this program work. Thank you all very much.

An important aspect of the program is its unique and flexible design. It enables each agency to fill its diverse set of needs and, at the same time, reach a broad range of small businesses.

Credit must finally, however, go to the small businesses themselves who have performed so well in this program. We heard from just four of the many, many successful small businesses; and we heard of their risk-taking, their innovative approach, their ability and creativity. They are the true stars of this program and to them goes the real credit for the program. It enables the Federal government to keep pace with transformations in the economy while sup-

porting a dynamic and innovative small business sector that will be the foundation of the economy in the 21st century. We support, as the administration supports, the continuation of this successful program.

Thank you for inviting me to discuss the program with you, and I will be happy to answer any questions you might have.

Chairman BARTLETT. Thank you very much for your testimony.

[Mr. Hill's statement may be found in the appendix.]

Chairman BARTLETT. The previous bells were going into recess and the present bells I think are coming back into session on the floor. So we can continue with our hearing.

Mr. Hill, let me turn to you for our questions and comments.

Mr. RICK HILL. Thank you, Mr. Chairman; and it is nice to see you again, Mr. Hill, Dr. Busch, and all those program directors. I think almost all of those, if not all of those folks, were in Montana just about 10 days ago or so I think; and it is good to see you here.

I don't have a lot of questions for you, but let me just compliment you on the work that you did there and the work that you are doing, particularly you Dr. Busch, in Montana.

In your testimony, Dr. Busch, you made the comment about the highly competitive nature of the program in keeping that as an element of the program. I presume what you are saying there is that you don't want to modify the program to have mandatory set-asides for this purpose or the other purpose. I mean, this is quality science and that is what we want to accomplish.

Mr. BUSCH. Yes, having been a small business person, as you were, Congressman Hill, I love the competitive environment. I think it is really a key cornerstone of the SBIR program, that it has been so highly competitive over the years. I think the numbers are roughly one in eight, on average, that is proposals accepted for award. That is very competitive.

Only the highest-quality proposals are funded, and there are many high-quality proposals that go unfunded. So I think it is really essential to keep that element in the program.

I think there has been a lot of discussion about mentoring and outreach today. The whole purpose of that, as I see it, is to try to level the playing field a bit for those who have some barriers not present elsewhere so that they, too, can have an equal shot at this competitive process.

Mr. RICK HILL. With respect to mentoring, do you have some specific recommendation there that we might do in the reauthorization process to urge that along or do you have——

Mr. BUSCH. Well, I think the program, Congressman Hill, that you, along with Senator Burns, helped push through last year as part of the SBA authorization bill that I referred to earlier, and that Dan Hill is now implementing at SBA is just an excellent model.

Mr. RICK HILL. That is enough? I said, is that enough? That is enough? No. That is a question.

Mr. BUSCH. I think it is a very good program. It is very lean, if you talk to the State folks who are very anxious to compete if the program. I do think the funds need to be increased.

I want to emphasize that that program should stay competitive. Too many programs have gone noncompetitive, and their effective-

ness goes down with it. So I think that program should be very effective.

As I mentioned, the agencies have to be key partners in this outreach process. So that led to my recommendation that consideration for resources be provided to them that they can join with the States in this outreach activity.

Some of the earlier witnesses suggested that the agency should have primary responsibility for outreach. While I think they are a key element, I think it would be a mistake not to have the States take the lead in the SBIR outreach and buy into it through a match requirement as is implemented in the current SBA SBIR outreach program. The States have to want this, and they have to pull this outreach wagon. Pushing it from the Federal side alone, I am convinced, will not work.

Mr. RICK HILL. Mr. Hill, do the agencies just meet or do they currently exceed the targeted levels, the percentage targeted levels?

Mr. DANIEL HILL. Let me preface this, when the SBIR program was created in 1982, Senator Rudman in the report language urged the agencies not to work to the rule. In other words, when the percentage was enacted back then it was very low and when it is increased, his fear was that research and development work that had already gone on in small business would then decline and they would only do up to the mark set under the SBIR program. And, in fact, that is what has happened. They do work to the mark, and they do make their intended budget marks as far as they report it to us.

There is an ongoing debate and, as I have reported before and the GAO has reported, as the various agencies develop their SBIR funding limits or ceilings each year it turns out that each agency does it a little differently. We have had many concerns about that over the years at the SBA; and we have, working with the GAO and with this Committee, tried to resolve those issues.

It is still an outstanding issue. Agencies are still, despite our best efforts, calculating their budget in different ways and different fashions. We have sent letters to the Chief Financial Officers at each agency. We have asked for guidance from the GAO and the committees. But this is still an outstanding issue.

Mr. RICK HILL. Is that something we ought to address in reauthorization here in the Congress?

Mr. DANIEL HILL. I am not sure it needs to be addressed by legislation, although it is beginning to appear that way. We have been struggling with this for a number of years now. And we want you to know, clearly, we don't want more money than we are supposed to have. I mean, we clearly would love to have 25 percent, not 2.5 percent. But, clearly, there needs to be a level playing field across the agency lines.

Mr. RICK HILL. And does that also make the argument for that Congress should perhaps consider increasing that percentage?

Mr. DANIEL HILL. At this point, I am not in a position representing the administration to urge you to do that. But there are a lot of considerations that would fall into that thinking, yes.

Mr. RICK HILL. The other recommendations—increasing the level for Phase I, do you think that—do you agree with the recommendations?

Mr. DANIEL HILL. Well, I would like to study that.

Currently, the agencies have the ability to do that on a case-by-case basis. I am aware of only one agency that is currently doing that. I would be interested in looking at that. I agree with Chris and what we heard on the earlier panel. The program ain't broke. Let's not try and fix it.

There are a number of authorities vested in the SBA through the issuance of our policy directives that gives me the latitude to investigate and rule on issues such as this, and I have favorably reviewed and approved requests to exceed the limits. I have also reviewed favorably requests when you are doing a Phase I at one agency; you don't need to repeat it at a different agency to stay in the program.

So my view right now is, although I have heard today from the witnesses, there is not a clamor or demand out there that has come to me on this. I am certainly willing to look at it if demand seems to rise. But, currently, we are handling it on a case-by-case basis; and, in most cases, I am approving those requests.

Mr. RICK HILL. Thank you very much,

Mr. Hill.

I have some more questions, but I guess we have to go to the floor. Is that correct?

Chairman BARTLETT. We will have to go to the floor in a few minutes, and when we run out of time here we may submit additional questions to you to be answered for the record for both panels.

You mentioned Dr. Busch, that more funding was needed. Is that just for the outreach rather than the whole program?

Mr. BUSCH. Yes, that is what I intended to convey.

Chairman BARTLETT. It is more funds for outreach.

You also mentioned something—I noted in your prepared testimony and you also mentioned it in your oral testimony—that we needed to have some uniformity in calculating extramural budgets. Do you think that some of the agencies are using calculations that underestimate the amount of monies that this 2.5 percent are applied to?

Mr. BUSCH. I think it is quite generally accepted that many agencies would like to reduce the SBIR set-aside if there was a way to do so. And I think—I don't have any hard evidence, but I believe it is true that there are some actions which had the net result of reducing the SBIR's set-aside in some agencies.

Chairman BARTLETT. Is there something that we need to do in reauthorization that would assure uniformity in computing the extramural budgets?

Mr. BUSCH. I am really not qualified to give an intelligent answer to that, Mr. Chairman. The April, 1998, GAO report spoke to this issue; and Dan Hill is much more on top of that than I am. I would defer to Mr. Hill.

Chairman BARTLETT. But if legislatively there is something we could do there, it is probably something we ought to look at, in your view.

Mr. BUSCH. If that is required, I would very much like to see it.

Chairman BARTLETT. Mr. Hill is shaking his head in assent, also. So that is one thing we will ask the staff to look at in potential changes in reauthorization.

Mr. Hill, you mentioned research goals, companies' research goals. Are you talking about basic research or are you talking about the research in R&D?

Mr. DANIEL HILL. For small businesses, most of the work is in applied R&D, not in basic research.

Chairman BARTLETT. So the research you are referring to is the research in R&D.

As you know, our country, as a major industrialized country, commits a smaller percentage of its GDP to basic research and to R&D than any of our economic competitors. This ultimately will be very hurtful in terms of economic competitiveness. If you don't do the basic research, you don't have the R&D. If you don't have the R&D, you don't have the products. My question is, could we help in a small way to correct this deficiency in our country by increasing this percentage from 2.5? Because I think, almost by definition, all of this money is going for R&D, is that not correct?

Mr. DANIEL HILL. There is a limit in the authorizing legislation on the amount of basic research that may be performed by small businesses under the SBIR, and we are not allowed to exceed that limit. But certainly a rising tide would raise all boats.

I would like for the record to say that the SBA—in years past, there has been this huge debate: Do we fund universities more? Do we fund small businesses more? Do we fund big businesses more? Our view at the SBA is that basic research and R&D research is so important and critical to the economic development and sustained growth that we ought to be looking at all of them. And instead of arguing over who gets what piece of the pie we feel very strongly that pie needs to be bigger. I couldn't agree with you more.

Chairman BARTLETT. Essentially all of the money in the SBIR program would go under the heading of R&D.

Mr. DANIEL HILL. No. There is a small percentage of it that is allowed for basic research.

Chairman BARTLETT. Okay. But it all goes for basic research and R&D, but most of it R&D.

Mr. DANIEL HILL. Yes.

Chairman BARTLETT. So if we were to increase the percentage, that would then put more money in research and R&D, which we really need to do. Because I think you understand and most of the people in this area understand that, unless we do that, we will have increasing future problems in economic competitiveness. Ultimately, it becomes a national security issue. Because unless we are doing more basic research and more R&D, we will not continue to have the world's foremost military. So there are lots of reasons to put more money in this area.

Mr. DANIEL HILL. Yes, sir.

Chairman BARTLETT. Mr. Hill, have you additional questions?

I want to thank both panels very much for your contribution; and the Committee will be in adjournment.

[Whereupon, at 12:15 p.m., the Subcommittee was adjourned.]

APPENDIX

ROSCOE BARTLETT, MARYLAND
CHAIRMAN

DANNY K. DAVIS, ILLINOIS
RANKING MINORITY MEMBER

Congress of the United States
House of Representatives
106th Congress
Committee on Small Business
Subcommittee on Government Programs and Oversight
B-363 Rayburn House Office Building
Washington, DC 20515-0516

OPENING STATEMENT

CHAIRMAN ROSCOE G. BARTLETT
SUBCOMMITTEE ON GOVERNMENT PROGRAMS
AND OVERSIGHT
HOUSE COMMITTEE ON SMALL BUSINESS

Good morning. Let me call the Subcommittee to order. It is a pleasure to welcome you to this hearing of the Subcommittee on Government Programs and Oversight of the House Small Business Committee. I would especially like to thank those of you that have traveled some distance to participate in this hearing.

The hearing will examine the performance of the Small Business Innovation Research (SBIR) Program which was signed into law by then President Ronald Reagan on July 22, 1982. It was most recently reauthorized in 1992 to extend through the end of fiscal year 2000.

While the SBIR Program enjoys bipartsan support because it has been successful, we have a responsibility to examine every government program for continued effectiveness and to consider ways in which they can be improved. I always want to make sure the federal government gets its money's worth from Americans' hard-earned tax dollars.

The SBIR Program fosters innovative research and development by small businesses and strengthens the country's technology base. The Program draws upon the skills and capabilities of small high-tech companies that, as a group, have shown the ability unequaled by large businesses to produce new products, processes, and technologies.

The SBIR Program has been credited with creating new jobs, increasing productivity and economic growth and helping combat inflation and stimulating exports. Small high-tech companies, as a group, have shown an ability unequaled by large businesses to produce new products, processes and technologies. The Program finds widespread support among members of both parties.

The hearing will provide program oversight and a basis for legislation reauthorizing the Program. The hearing will examine recommendations for legislative and administrative changes that you may offer during the hearing. Your views concerning the present and future operation of this important Program are most welcome.

Again, welcome to our participants and guests. I look forward to hearing your comments on this most important program.

Al Behar, President PICS, Inc.

Written Testimony

US Congress

Sub-Committee on SBIR

May 27, 1999

Thank you for the opportunity to tell you our story and give you my input on the SBIR program. My testimony will focus on my company's unique approach to tackling tobacco addiction and other health problems related to diet and exercise that face the United States and other industrial nations, the success that PICS* has enjoyed thanks to the SBIR program and recommendations for its potential improvements.

Before I get on with my testimony, I would like to express my appreciation to the SBIR program and its administrators at every level of the National Institutes of Health. In particular, I would like to acknowledge the fine work of Mr. Sonny Kreitman who, until his recent retirement, provided strong leadership to this program. I would also like to compliment Mr. Kreitman's successor, Ms. Jo Anne Goodnight. I have had the pleasure of meeting with Ms. Goodnight recently and am confident that she will do an excellent job coordinating the SBIR program. Finally, I would like to thank the NIH program officers and grants management staff for their advice on the full spectrum of issues we have faced over the years.

As you well know, tobacco addiction is the leading cause of premature death worldwide, yet in the US and Canada alone over 50 million people smoke and about 10 million people chew tobacco. Despite the vigorous anti-tobacco campaigns in both countries, over the last ten years these numbers have remained virtually unchanged.

The second leading cause of premature death in industrial nations is heart disease and strokes caused by combinations of obesity, elevated cholesterol, hypertension and diabetes, all of which are diet and exercise related. One-third of American adults are overweight (up 25% from 1980) and under-exercised. Another third of American adults are at increased risk of coronary heart disease due to cholesterol levels above 200. And yet another third of American adults suffer from hypertension or diabetes.

PICS' approach is to develop self-help programs that are implemented by hand-held computers. These programs, which are based on behavior modification, aim to help individual's battle tobacco addiction, lose weight, control cholesterol and lower hypertension. PICS has developed two computer platforms, LifeSign and DietMate, which are used in a variety of products, targeted toward consumers directly and to the professional community. LifeSign is a credit-card-sized computer that is the basis for four products that deal with the treatment of tobacco addiction: LifeSign for Adult smokers, LifeSign for Pregnant Women, LifeSign for Dipper and Chewers and most recently LifeSign for Teens and Young Adults. LifeSign works in two stages. During the first stage, which lasts 7 days the computer collects information about the users' cigarette consumption. Based on the data from stage 1, during stage 2 the computer prompts the user when to smoke, by flashing an icon and beeping and gradually increases the time interval between successive cigarettes until the individual is no longer smoking. For more details on the LifeSign family of products and its scientific validation, please visit http://www.LifeSign.com.

Our DietMate family of products is based on a palm size computer and comes in three versions: weight loss, cholesterol reduction and high blood pressure treatment. Each version of DietMate creates a personalized plan based on the user's weight, age, gender, height and long and short-term goals. Because DietMate is based on behavior modification, the computer guides the user to make gradual changes to their eating habits and exercise patterns. For more details on the DietMate family of products and its scientific validation, please visit http://www.DietMate.com

Because of the scope of the problems we address, our work has enormous public health significance and enviable commercial potential. In fact, the combination of self-help convenience and hand-held portability coupled with the power of computers to personalize treatment yields uniquely efficacious products that are popular with users and are easy to disseminate widely and quickly. Clinical trials have shown that our LifeSign Stop Smoking program matches the efficacy of drug treatments at a fraction of their cost, and without the risk of side effects. Not surprisingly, LifeSign and DietMate have sold over 1,000,000 units, world wide, and have generated over $100 million in sales. To date, LifeSign has enjoyed success in the US, Canada, Latin America, Australia, Japan and numerous European countries.

PICS employs about 20 full time employees and numerous consultants through outsourcing. Furthermore, we have been awarded three patents for our LifeSign and DietMate technology.

The SBIR program has allowed PICS to engage in extensive product development, which normally would be reserved only for large corporations. SBIR has helped us pioneer innovative approaches to major health problems which have earned us the respect of the scientific community, while allowing us to capitalize on our rigorous research efforts by commercializing our product ideas. Furthermore, the SBIR program has allowed us to maintain a degree of stability despite the many ups and downs experienced by small businesses.

There is a great deal right with the SBIR program as currently administered. However, there are always ways to improve on a good thing.

First, I recommend that the SBIR program change its organizational structure and composition by tailoring study sections to multi-disciplinary projects. In the wake of the tobacco settlement, there is an urgent need to study the many questions involved in large-scale prevention, education and cessation interventions. This requires the Center for Scientific Review to pay close attention to the study sections specifically designed to review multi-disciplinary innovative applications. This approach would ensure that the breadth of technical expertise necessary to review these types of applications exists. Thus, tailoring study sections to the multi-disciplinary projects is a concept that is well overdue.

Second, I suggest you revise the operating principles and practices so there is a balanced approach to solving the complex challenge of tobacco control. The tobacco settlement has raised the need for the full spectrum of research issues to be addressed, encompassing research styles spanning from "Hypothesis Driven" to "Problem Solving". Hence the need to charge reviewers to rate all styles of research equitably, to ensure a balanced approach to solving the multi-faceted tobacco control challenge.

Third, the SBIR program needs to promote system agility by having flexible peer review. The landscape of tobacco control solutions will be changing rapidly in the coming years through the combination of the availability of tobacco control funds from the states' settlements, taxation of unprecedented magnitude, and the acceleration of knowledge in the biological, behavioral and technological sciences. Therefore, peer review needs to be flexible enough to adjust to these continually changing forces.

I am happy to report that over the last few months we have been working diligently with members of the NIH administrative staff in developing additional recommendations aimed at streamlining the application process and modernizing the review process. My more detailed recommendations are included in my written testimony. Here, I'd like to highlight one key recommendation related to Phase I funding. The present $100,000 limit on Phase I, although adequate for many fine projects, falls short of what is needed to attempt to tackle some of the more complex health issues that our society faces today, such as AIDS and Cancer. In contrast, I have found the $750,000 limit on Phase II sufficient. Therefore, my recommendation is limited to increasing Phase I funding level to $200,000.

In closing I would like to thank you again for giving me the opportunity to express my opinion on the performance of the existing SBIR program and offer my recommendations for potential improvements.

* PICS, Inc. is the successor to Health Innovations, Inc. which in turn was the successor of Behar, Inc. which was founded by Mr. Al Behar in 1984. All companies were headed by Mr. Behar, shared the same mission and engaged in the same research and development and business activity as the present PICS, Inc.. Therefore, all accomplishments are attributed to PICS, Inc.

Testimony by Dr. Judith A. Armstrong, CEO
ADA Technologies Inc.

Small Business Innovation Research (SBIR) Program Oversight and Reauthorization,

A Case History & Some Recommendations

Testimony Submitted to:

Committee on Small Business
Subcommittee on Government Programs and Oversight
U.S. House of Representatives

Presented May 27, 1999
by invitation from Chairman Roscoe G. Bartlett

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Introductory Comments

I want to thank Chairman Bartlett for the invitation to testify today. My business, ADA Technologies Inc. (ADA), has been an active participant in the SBIR Program since receiving its first award from the Environmental Protection Agency in 1985. ADA was founded by me, then a Senior Scientist with Hughes Aircraft Company, and several researchers from the Denver Research Institute, a department of the University of Denver.

Today, ADA is a company of 35 scientists and engineers with annual sales of $4 million. Without the SBIR Program, ADA would never have been founded and the careers of its founders would not be devoted to technology commercialization as they are today. All three founding members continue to make a technical and economic impact, far different from the career paths they were on in 1985.

I would like to spend my time giving you some background information on ADA and telling you about its current strategic focus. It is also relevant to look at the activities of ADA in light of the four purposes of the SBIR Program. I have some general comments to make about technology commercialization and the local impact SBIR funding can have on economic development. Finally, based on years of discussion with many of my co-participants in the SBIR Program and with other interested parties, I have three recommendations that I would like to offer.

ADA Technologies Inc. – The Beginning

The early days of ADA were spent working in the house of one of the founders. After about eighteen months, we took the plunge and signed six-year, personal guarantees on 3,500 square feet of office space. From the first days, we searched hard to find the best researchers in the country for the areas in which we proposed to get funding through the SBIR Program – we talked to universities, professors, other small businesses, and some larger businesses. Alliances with others have always been a key to our success. At that time, the National Labs were not on our radar screens.

We learned to be profitable and to build infrastructure. We used our resources to build strategic plans, a staff with impeccable credentials, chemistry labs, machine shops, and an overriding interest in creating highly innovative yet applicable technology. We learned how to use government funds for our own R&D projects, giving us competitive advantage through ownership of a broader scope of intellectual property. We realized that merely providing services was piecework, earning compensation based only on the hours billed.

We began to see commercialization of innovative, proprietary technology as a path to faster growth and more net income – and also as a means of adding value and providing benefits to our clients and the nation. We devoted energy to learning the differences between being market-driven and technology-driven. We took classes at Cal Tech, got MBAs, read books, and joined CEO groups. We learned new skills - different from what we learned as scientists pursuing PhDs in engineering and mathematics. We thrived on the challenges of applying what we were learning.

ADA - Strategic Focus Today

ADA's strategic focus is stated to be "To improve the lives of the world's populations through innovative technology." To achieve this, ADA is trying to emulate the model of 3M, which has asked its researchers to provide a rotating base of product innovations on 5-year intervals. The time frame of the SBIR Program fits into that model.

In the last five years, ADA has produced two innovative technologies that we believe improve the lives of the world's populations. In 1996, ADA Environmental Solutions LLC (ADA-ES) was formed to help utilities comply with the Clean Air Act Amendments while they provide the nation with the power it needs on an efficient basis. ADA-ES is selling flue gas conditioning systems, which were developed through a series of related, synergistic SBIR awards, as well as regular Department of Energy Program Research and Development Awards. The solution to the utility industry's problem was many-faceted and required technology innovations related to particulate control, in-stack chemistry, and fly ash characteristics – among others. To obtain sufficient resources for Phase III (commercialization beyond SBIR funding), ADA Technologies Inc. sold ADA-ES in a stock and cash deal valued at $8.3M.

ADA technology innovation has also been the genesis for Tek-Gear LLC of Jackson, WY, now operating from Boulder, CO. Tek-Gear manufactures a datalogger, "Trekker", which is being sold today to allow high school science students to conduct efficient, state-of-the-art laboratory and field experiments. ADA prototyped the Trekker through Department of Energy SBIR Phase I and II grants. ADA is the developer of TrekSoft, a companion product that teaches students about data manipulation on a PC or MacIntosh. ADA invested over $200,000 of its own resources to learn about the market and attract an investment group to create Tek-Gear. That group has invested over $600,000 in the successful commercialization of Trekker, now a strong competitor with the CBL, a comparable product made by Texas Instruments. In many cases, the Trekker is actually preferred by the teachers.

Among our technologies of the future are likely to be (1) more efficient demand-defrost control units for the millions of commercial refrigeration units in existence, potentially saving billions of dollars in electricity and mitigating peak demand cycles for utilities; (2) software modules and games to improve science learning by students of all ages; and (3) cost-effective mercury-control technology that will enable utilities to comply with future clean air requirements.

ADA is organized as a technology incubator. Individual staff members or teams who champion a technology are then given access to the skills needed to create a business. Continued success will bring more success stories for ADA and will give more individuals an ownership stake in the ultimate outcome.

ADA Measured Against the Four Purposes of the SBIR Program

Purpose 1: To stimulate technological innovation.

ADA has received 9 patents and has 1 application pending. They correlate closely with SBIR projects and with ADA's commercialization successes.

ADA has developed a culture that encourages and rewards individuals for successful technological innovation. Maintaining that culture is a key component of ADA's continued success. The process itself is the result of blending managerial innovation with technical innovation – much of the latter having been initiated by SBIR projects.

Purpose 2: To use small business to meet federal research and development (R&D) needs.

ADA has worked closely with several DOE agencies to help them meet their R&D needs. Several of the technologies on which ADA has worked do not yet have urgent regulatory drivers and would not be developed otherwise by corporate America. With SBIR funding, ADA has been able to pursue cost-effective techniques and to develop capabilities that will now assist the government with establishing reasonable environmental regulation -- most often it is based on the MACT or BACT concept -- i.e., regulation is put in place based on the maximum or best achievable control technology. Early development of these advanced technologies by ADA allows the EPA and other government agencies to formulate strategies for managing the environment that have substantially lower cost and future investment needs, while at the same time forming the basis for products that will meet the needs of the private sector.

Currently, ADA is developing a beryllium monitor for real-time measurement of airborne particulates, and a swipe analyzer for detecting the presence of beryllium during decontamination and decommissioning of DOE weapons facilities. Beryllium is not used in the commercial marketplace. However, its measurement need is critical to the DOE, which is required to protect workers from berylliosis, a disease similar in toll to black lung disease in the mining industry. ADA is working with Los Alamos National Lab scientists in this development, as well as with Sandia National Labs. (The Department of Defense also has some need, which we are now exploring.)

ADA is also working on mercury measurement and control in air, ground water, and soils - all needed in the clean-up of the DOE weapons complex. ADA's pending patent is for the treatment of elemental mercury in the DOE mixed (radioactive) waste inventory. The commercial spin-out from this activity relates to the control of dental amalgam that is currently being released into publicly owned (water) treatment works (POTWs). Additional commercial applications will follow.

ADA's staff of thirty-five scientists and engineers thrives on the technical challenges of these unique program requirements, and SBIR funding is combined with other sources of public- and private-sector funding to meet important needs of government agencies while pursuing related commercial applications.

Purpose 3: To foster and encourage participation by minority and disadvantaged persons and women-owned businesses in technological innovation.

ADA has been woman-owned since its inception in 1985. Without the support provided by SBIR's, I doubt that I would have stayed in technology innovation, but might have used my skills in general business management or marketing. My contribution would have been significantly different.

I believe the SBIR Program has allowed me, as a female mathematician, to approach technology innovation from a perspective that differs from that of the majority of scientists and engineers. I rely heavily on instincts, intuition, people skills, and relationships in going about my business – all recognized characteristics of women in leadership roles. The Phase III commercialization activities needed for success come naturally to me, and I have coached many members of my staff to see the importance of the *people* in the technology process, the emotional factors in sales and marketing, and the importance of seeing government agencies as customers.

Purpose 4: To increase private sector commercialization of innovations derived from federal R&D.

ADA's R&D activities have resulted in a return-on-investment to the federal government of 321% from commercial activity. The government has invested $6.6M in ADA through the SBIR Program, and ADA has returned $21.2M in matching funds from commercial business.

In addition, federal R&D produces innovations in the National Labs, universities, privatized government labs, and consortium projects involving large and small business. ADA has been involved in activities with members of all these groups. They now include Sandia National Lab, Lawrence Livermore National Lab, Los Alamos National Lab, the Federal Energy Technology Center, and others. For example, the technology used in the beryllium instruments was first prototyped by scientists at Los Alamos National Lab.

The two activities -- working to commercialize technology funded by the government, and supporting the federal government's R&D mission -- are synergistic. At ADA, the SBIR Program has been instrumental in allowing us to orchestrate the integration of all these resources.

General Comments

1. ADA now has thirty-five employees with an annual revenue base of $4M (Figure 1). Based on SBIR work, the company has also formed a spin-out which attracted an investment valued at over $8M.

2. Of ADA's $3.8M in revenues in 1998, $1.1M was spent on consulting fees, subcontracts, and buying advanced technology products from vendors located throughout the United States (Figure 2).

3. ADA has worked with many universities and academicians (Figure 3).

4. ADA's revenue has generally been derived from the SBIR Program and other government funding sources in like proportion, with an additional 20% coming from commercial customers (Figure 4).

5. ADA has provided the government with $31M as a return on its $7M SBIR investment (Figure 5).

6. ADA has spent a significant amount of time mentoring other entrepreneurs and companies in Colorado. I started an organization called SBIR Colorado, which ran from 1990 to 1996. It provided significant support to start-up companies through networking. A small amount of seed money, $10,000, was provided through Project SBIR West. The momentum of the SBIR Colorado came from experienced SBIR winners, local support services firms, and through dues of the member companies. SBIR Colorado was able to produce two video tapes: one promoting the SBIR program to beginners and the other giving a case history of an ADA licensing success with Land Combustion of Bristol, PA. There were sixteen dues-paying member companies, twelve strategic partners from corporate America, and six networking support partners (Figure 6). Quarterly networking events were attended by up to eighty individuals.

   SBIR Colorado also founded a CEO roundtable, based of the model of The Executive Committee (TEC), for Colorado companies. It met monthly at ADA. One of the 1998 Tibbetts Award winners was part of this group (Figure 7). I personally view myself as a mentor to its participants, as well as several other Colorado companies that now exist as a result of developing winning SBIR proposals based on long-term business strategies.

   ADA has also strongly supported several national organizations that have provided SBIR education, outreach, and mentorship over the years.

   (The U.S. Small Business Administration statistics for SBIR wins between 1990 and 1996 show the impact of SBIR Colorado. Lack of funds and excessive time demand on the experienced winners caused its demise.)

7. Economic development along the Colorado Front Range, especially the software, optics, and telecommunications businesses, is highly stimulated by the SBIR Program.

Recommendations

1. ***The SBIR Program has proven its success and requires no changes.*** This highly competitive program works efficiently. I believe talented technologists with the will and commitment can use the SBIR Program as it exists to prototype new ideas and attract funding to complete a commercial product. I do not believe the fundamentals of the Program should be changed.

   I offer several comments based on my lessons-learned. For commercialization, I think both sides, the entrepreneurs and the government agencies, are just learning about the pitfalls of being technology-driven and are attempting to refocus on market forces and needs. In discussions with Hewlett-Packard, I learned that it is their corporate model to use multiplier factors of 1, 10, and 100 to go from prototype to product launch to development of a complete product line. The SBIR Program takes the 1, 10 jump from Phase I to Phase II, but then trusts that adequate work has been done to attract an investor to contribute 10 times the government's investment. This is a daunting hurdle and requires sophisticated technology and business skills on the part of the SBIR participant.

2. ***The Program should be extended at least 10 years.*** The SBIR Program has been dramatically successful in meeting the goals set by Congress. I firmly believe this will continue. I expect that two additional things will happen over the next few years. First, a new round of companies and technology champions will be created using the ever-increasing skills of the next generation of business and technical graduates of our universities and colleges. Second, a transition in ownership will occur in the already participating companies. The SBIR Program creates companies – in addition to ideas and technology. The average company in America lasts only 15 years. The next 10 years will see many of those companies now meeting the purposes of the SBIR Program formulating and implementing successful transitions to a new round of leaders -- with the benefit of all the lessons that they have learned. The companies that have grown and matured/evolved beyond the SBIR Program also represent some of the nation's best candidates to partner with new SBIR participants in Phases II and III.

3. ***A national mentoring program should be put in place.*** We need to reach out and get more businesses involved in the SBIR Program to keep it highly competitive and successful. Mentoring entrepreneurs in areas that may not be co-located with a university or federal laboratory will help achieve this goal. The activities of SBIR Colorado have demonstrated the significant impact of mentoring. It helps beginners avoid many of the pitfalls of learning to do business with the federal government, while allowing them to do what they do best. For existing companies with SBIR funding, it is an opportunity to learn more about success stories and to have help in making those early contacts with big business and the marketplace. Mentoring is definitely a mechanism that enhances the success of new and existing SBIR Program participants.

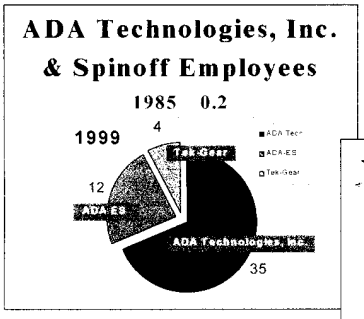
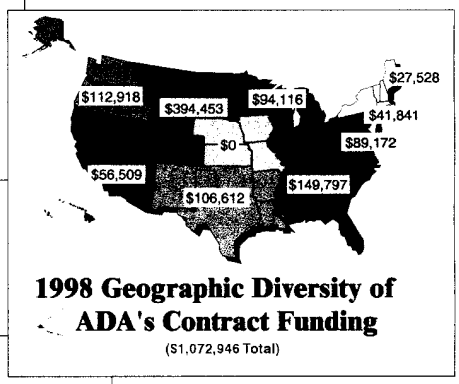


Figure 1



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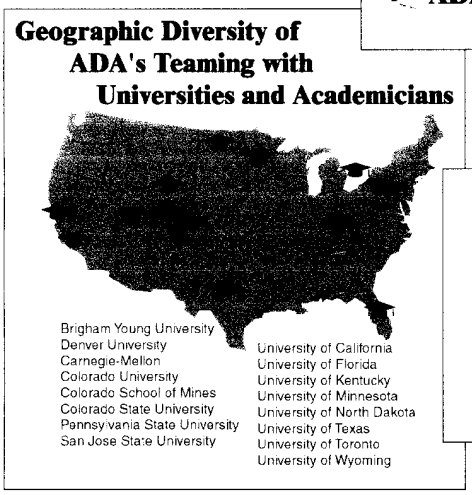

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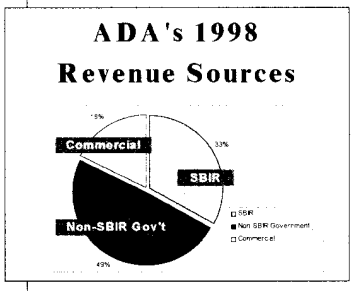


Figure 4

Return on Investment (ROI) to the Federal Government from ADA Technologies, Inc. 1985-1998

Funding Source	$ Amount (millions)	ROI
SBIR	6.6	
R&D services to the Federal Government (non-SBIR)	11.0	167%
Commercial Investment	21.2	321%
Composite	31.2	488%

Figure 5

ADA Technologies, Inc. has created an SBIR networking group within the state of Colorado.

Members:

ADA Technologies, Inc.
Applied Technologies, Inc.
APTEK, Inc
Ascent Technology, Inc.
Astralux, Inc.
Biofeedback Systems, Inc.
Eltron Research, Inc.
Geodynamics Corporation
Integrator Corporation
InterCommInternational, Inc.
IonEdge Corporation
Micro Analysis and Design, Inc.
Owen Research, Inc.
Photosense
Q-DOT, Inc.
TETRAD Crporation

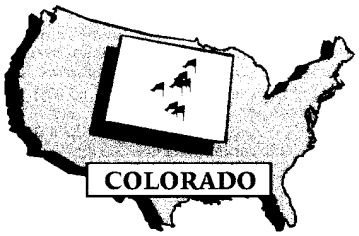
Abar Ipsen Industries
Automation Engineering Company
CH2M Hill
Coleman Research Corporation
GM Powertrain
KPMG PeatMarwick, LLP
Kelley & Associates
Lockheed Martin
Pratt & Whitney
Radian Corporation
Rose Biomedical Research
Technology Solutions Company

Support Partners:

Cheyenne Research Corporation
Force & Associates
Karsh & Company
New Venture Resources
Personalized Business Consultants, Inc.
Sheridan Ross &McIntosh

Figure 6

Colorado Companies Mentored by ADA Technologies, Inc.



- Ascent Technology Inc. - Boulder
- Clear Corporation - Boulder
- IonEdge Corporat on - Ft. Collins
- Meeting the Challange - Colorado Springs
- Owen Research - Boulder
- Q-Dot, Inc. - Colorado Springs
- 2B Technologies - Golden

Tibbetts Award Winner

Figure 7

Closing Comments

Thank you again for allowing me to speak. I hope that my comments will help with your deliberations. Feel free to contact me with questions: Judy Armstrong, 303-792-5615, judy.armstrong @adatech.com.

Invited Testimony before the
Subcommittee on Government Programs and Oversight
Committee on Small Business
Room 2360, Rayburn Building

May 27, 1999

Dr. Jacqueline Haynes
Intelligent Automation, Inc.
Rockville, MD

Good morning Mr. Chairman, and members of the Subcommittee. My name is Jacqueline Haynes. I am the owner of Intelligent Automation, Inc. (IAI), a small business located in Montgomery County, Maryland. It is indeed an honor for me to address this committee, and also a great pleasure to discuss the Small Business Innovation Research program.

I founded IAI with my husband Leonard Haynes 13 years ago, using an extra bedroom in our home as our office. You can imagine the DCAA auditor's surprise when he showed up there for our first audit. After a few months we made improvements to the basement and moved the office to this larger space. Since that inauspicious beginning, IAI has grown to an organization of nearly 50 technical staff, housed in an office building in Rockville, Maryland. We employ engineers, computer scientists, and social scientists who come from as far away as Taneytown and Frederick, Maryland to the north, and Springfield, Virginia to the south. We also have small facilities with IAI employees in Arizona and Connecticut. We currently have contracts with firms and consultants in Alabama, Arizona, California, Colorado, Connecticut, Delaware, Florida, Maryland, Massachusetts, Ohio, Texas, and over the course our 13 years of business, have had subcontracts and consultants in nearly every state.

From the beginning, my business grew through the SBIR program. Our government clients found us to be quality partners in their R&D programs, and I believe that this quality accounts for the success we have experienced in winning Phase 1 and Phase 2 awards from many government agencies over the years. And now we are experiencing success in transitioning many of the technologies that originated in our SBIR work into the commercial sector, by either licensing our technology or selling related products and services to large firms such as Motorola, Ford, and American Airlines, Nichols Research, and to law enforcement agencies throughout the U.S. and in many foreign countries.

The SBIR program has been an engine of growth for us, and we have been very successful in achieving the goals the SBIR program was intended to achieve. We are one

of those American small businesses that employs 36 percent of the nation's scientists and engineers; we are one of those small businesses that holds 38 percent of the newly issued patents. We have grown from doing $160,000 in business our first year to a projected $6,000,000 this year. We are an SBIR success story, but it doesn't end there. We re-invest nearly all the proceeds of our SBIR-related work into continued R&D and commercializing the technologies that we see have potential. Government agencies, taxpayers and the nation's economy get a lot for their money from our work. Our business goal is to realize profits from commercialization of our technology. SBIR funding is the means, and the beginning, but not the end. Our first year, 10 percent of our business was not from the SBIR program. Now, approximately half of our business is external to the SBIR program. We have contracts with large firms such as Lockheed Martin, Motorola, Ford, American Airlines, Nichols Research, and several foreign countries. Our ballistics-analysis hardware has been sold to over half the crime labs in the U.S. and many abroad. In every case, this business is the direct result of technology developed under the SBIR program.

Let me explain why I believe the SBIR program is crucial to businesses in supporting the type of innovative environment that effectively and efficiently brings new science and engineering ideas into the marketplace -- businesses like mine:

Many of the greatest success stories stemming from the SBIR program would never have "seen the light of day" had they been solely dependent on venture capital and other funding sources. Financial backing for conceptual notions and inventive thinking that doesn't lead to a short-term product, outside a university setting, is virtually non-existent -- certainly not without relinquishing control of scientific interests. Once you have a "proof of concept" or a preliminary engineering approach, perhaps you can attract outside backing. But getting to that point requires significant resources, financial investment and "sweat equity." It also requires time, and sometimes many attempts, before an innovation is mature enough to warrant interest in the commercial sector.

Innovation and creativity spawning good ideas and ultimately new products have been a major factor in America's gaining a competitive edge. It has been in this arena that IAI has excelled and continues to make contributions. It is also a realm in which the SBIR program is one of the few players. I want to take the opportunity now to tell you more about my company, some of the important contributions we have made and the role that the SBIR program has served as a major catalyst to these accomplishments.

Even among research and development firms, Intelligent Automation is a very different sort of company. Rather than specializing in one core technology, and developing products focused on penetrating a very specific commercial niche market, IAI has sought to maintain its character as a R&D "think tank," focused broadly on applications of artificial intelligence and the products that result from them.

The interests of our scientists span a broad range of domains, from robotics and manufacturing, to the Internet and education. We respond to government and commercial

customer needs by developing solutions to complex problems using modern technology in innovative ways, or by developing new technology. We then take our ideas, design, build, and test prototype systems. Those technologies that display market potential become part of a concerted commercialization effort. As part of our strategy, we have aggressively pursued SBIR solicitations. As a result of our creative ideas, talented staff, hard work, and record of superior performance, IAI has been very successful at receiving a number of SBIR Phase 1 and 2 awards. IAI has also made substantial progress in commercialization and product development activities and is well along in the transition from a firm highly dependent on SBIR funding to one which utilizes SBIR funding as one resource in a maturing program of technology development and deployment. Our basic approach to commercializing our SBIR results is based on teaming with partners who have existing products, marketing capability, and a reputation as producer of related products. This approach has resulted in our very successful commercialization of several products. At this point I will highlight some of our major technological developments that were made possible by the SBIR program and which are providing very important benefits to our Nation.

Forensics Imaging Technology

SBIR funding has lead to an important product line for IAI, and has established us as a world leader in forensics imaging technology. Over half the crime labs in the U.S. and several foreign countries now have Intelligent Automation's ballistics analysis system. Our work began as part of a Phase 1 SBIR contract from the Ballistic Missile Defense Organization. During our research, we developed a new type of neural net called a Fuzzy CMAC, which can be used for a wide variety of applications, including image analysis. We felt the Fuzzy CMAC could be used for automatic classification of fingerprints, and we therefore approached a company called MSI because of their experience in fingerprint analysis, and their market position in the law enforcement community. Our interaction with MSI, now Nichols Research, resulted in a commercial partnership to pursue automated matching of bullets. The scratches (striations) made by a gun barrel on a bullet when the bullet is fired create a "signature" that a firearms examiner matches to the striations on other bullets fired from the same gun. The process is a manual process and is very time consuming. If a bullet is recovered from a crime scene, it can be compared to a bullet test-fired from the gun of a known suspect, but it is not feasible to compare a bullet recovered from a crime scene with the thousands of guns recovered from potential suspects. With our new technology, the gun's signature on a bullet can be compared to a large database of such signatures, and matched automatically.

We built a device we call "RotoScan" to capture and digitize the image of the striations on fired bullets, ultimately leading to a product that enables computer searching of files of past crime scene bullets so that a gun can be test fired, and the resulting bullet scanned and matched against the database. RotoScan is now one part of the FBI's Drugfire ™ system. We have sold over 110 RotoScan units.

We have now obtained a Phase 2 award from NSF, non-SBIR research funds from the National Institute of Justice, and a private commercial investment to develop a three-dimensional version of RotoScan. We expect to begin selling this 3-D version of RotoScan as well as a 3-D retrofit kit as early as Spring 2000. Current two-dimensional ballistics analysis techniques are often not usable on Glock firearms, which are becoming increasingly popular, and are also ineffective on high power rifles such as that allegedly used to assassinate Dr. Martin Luther King. Our 3-D RotoScan technology will alleviate both those shortfalls.

At this year's meeting of the Association of Firearms and Toolmark Examiners, awards were give out for "hits." A hit is when a suspect is identified through computer matching of a test fired bullet from an illegal gun taken from someone, and matched by computer with an unsolved crime. Many examiners received awards for 1000 hits using DrugFire.

Because of our expertise gained from these developments, we received a contract from the Drug Enforcement Administration and Nichols Research to design and build a high pixel-density capture device for the forensic analysis of illegal drugs. This device, called PillScan, is able to match a specific pill, capsule, or tablet to the specific machine on which that pill was fabricated. In addition to assisting the DEA in examining drugs and related paraphernalia, this device can also be used for other applications including examining jewelry and counterfeit documents and currency.

Hexapod Precision Devices

Intelligent Automation completed a Phase 1 and 2 SBIR award from the National Science Foundation to design a new class of high speed, high precision machine tools based on a hexapod-configured device called a Stewart Platform. Upon completion of Phase 2, IAI transferred this technology to the Ingersoll Milling Machine Company. Using the IAI configuration and much of our software, Ingersoll took a variant of this machine to market, and have sold numerous units worth many millions of dollars. Two of these machines are located at the National Institute of Standards and Technology and Sandia National Laboratory.

We extended our technology in hexapod systems to the development of a new class of exercise and physical therapy machine. NASA awarded a Phase 1 and Phase 2 SBIR to us to use this Stewart Platform technology in exercise equipment for astronauts to use onboard the International Space Station. This technology solves the problem of devising space-deployed exercise equipment that requires weight resistance to be effective. The devise is light, easy to assemble, versatile and compact – requiring very little space when stored. It provides a method to maintain and assess levels of aerobic and anaerobic physical activity. We expect to conduct our initial demonstration of the device within three months and we are engaged in discussions with several prospective home and health club exercise equipment manufacturers. The technology is also directly applicable for physical therapy, and we are working with the University of Delaware Department of Physical Therapy to apply our technology to this important application.

Internet Technology

Our SBIR-funded work developing personalized methods of using hypermedia to optimize learning outcomes led to the development of Intelligent Automation's unique approaches for Internet search and navigation tools. Following this SBIR-funded research, we developed a set of proprietary Web tools and methods that led to developing important markets for IAI within the regional and state government sectors, and in the commercial sector. Our method demonstrates the educational utility, yet relative ease, of providing "user-centric" search and navigation on the Web. Our innovative "COOL Link" is a one-to-many link that facilitates web navigation by various individual users, each of whom would be directed to the link most appropriate to their own user profile. We produced tools, techniques, and data specifications to support the development of individualized, Web-based, educational materials for Department of Defense Education Agency (DoDEA) curriculum.

Also, from Navy SBIR Phase 1 research (with a Phase 2 still pending), we are planning to bring to market an innovative type of adult literacy tutor called "LADDER." LADDER uses a novel technology for text analysis to provide automated guidance to readers in selecting appropriate reading material, based on multiple, automated assessment of their comprehension of what they read last. We are collaborating on this project with colleagues in Colorado. If additional development and research on efficacy is funded by the Navy in Phase 2, we expect that LADDER will be part of a major publisher's product line for the adult education market, the community collage market, and as a tutor for children in grades 4 through 8.

Our technological prowess in the Internet/Web technology has also lead to IAI becoming a developer of specialty websites for enhancing the effectiveness of complex business and government operations and applications. We are developing websites and associated Internet technology for clients such as American Airlines and the Census Monitoring Board. We are using the same technologies for developing Web-based Intelligent Transportation Systems training programs for a regional consortium.

Control Technology

Intelligent Automation has won several SBIR awards applying our innovative control approaches to various applications. One result of this coherent body of research is the development of a powerful multi-DSP based parallel computing platform for executing complex multiple channel digital control algorithms while also being expandable and flexible. We have sold a number of these units to commercial and government clients. Our application of this technology to vibration isolation at the Jet Propulsion Laboratory is included in the NASA SBIR success stories on their SBIR web site.

Our expertise in control technology has now led to our being awarded three contracts with the Ford Motor Company to develop state-of-the-art computer controlled electronic

test equipment. As a direct result of a still-ongoing NASA Phase 2 SBIR program in equipment health monitoring and prognostics, we have a contract from Ford Motor Company to install a beta-version of the system on critical equipment at Ford's Rawsonville, Michigan plant. If this is successful, other of Ford's critical machines worldwide have been identified as candidates for our new technology. Our relationship with Ford has also resulted in two other contracts to purchase IAI-designed and manufactured test equipment, plus a new joint project in robotic assembly of power train components.

Impulse Radio

Together with a Company called Time Domain Corporation in Huntsville, AL, we are now working on a very exciting new type of radio which does not use radio waves. A recent front page *USA Today* article compared the impact of this technology with the light bulb and the transistor. It will allow 100 times faster data communication rates than conventional radio, and does not require any spectrum allocation. We have completed a Phase 1 SBIR project for the Army applying this technology to terrain mapping for a mine-clearing vehicle, and are just beginning an Air Force Phase 1 project to apply this technology to Phased Array Radar. This funding will support the development needed to commercialize this technology over a wide range of applications.

Summary

As you can see the SBIR program has been instrumental to our technological developments, product development, entry into the marketplace, and growth as a company. I know of other companies like mine that have benefited from this program and in turn benefited the nation with the result of their work. The SBIR program has already proven to be successful in achieving its goals of promoting innovation and scientific development, encouraging entrepreneurship, and giving government agencies a high quality return on R&D funds.

Recommendations

Would I recommend re-authorization of the SBIR program? Of course. It's good for my company, it's good for the government agencies that participate, and it's good for the nation. The success of the program speaks to its structural integrity, so that significant changes to it are likely to be more damaging than helpful. Would I like the amount of the overall program to be increased? Certainly. Would I like individual contract amounts to be increased? Yes – especially for Phase 1.

In closing I want to reiterate my strong support for the SBIR program. Two decades ago, you may recall that America was falling behind the Japanese and European countries in a number of key technologies. Our competitiveness was in jeopardy. It was during this time period that the legislation initiating the SBIR program was first passed. I have no doubt that the SBIR program played an important role in the resurgence of our nation's technological prowess.

Overall, the SBIR program is one that works for my firm and for many like it. My strongest suggestion is simply to re-authorize the program for the next 10 years of innovative small businesses in America.

I am happy to address any questions on our participation in the SBIR program or other matters that my testimony may have raised.

AAES AMERICAN ASSOCIATION OF ENGINEERING SOCIETIES

Testimony of Dr. Arvid G. Larson to the
Subcommittee on Government Programs and Oversight
House Committee on Small Business
May 27, 1999

Mr. Chairman and Members of the Subcommittee:

My name is Arv Larson and I am Co-Chair of the American Association of Engineering Societies' (AAES') R&D Task Force. AAES is a federation of engineering societies dedicated to advancing the knowledge, understanding, and practice of engineering. Its member societies represent more than one million U.S. engineers in industry, government and academia.

I want to thank you for the opportunity to testify in support of reauthorizing the Small Business Innovative Research (SBIR) program. I was quite privileged to be able to present my views in favor of this legislative initiative in 1982 when I testified during SBIR's first authorization hearings. In the intervening years, the SBIR program has found success far beyond what we initially envisioned. I am pleased to see that those efforts of the early SBIR advocates have proven beneficial. SBIR is now a thriving program providing essential assistance to small entrepreneurial companies. The demonstrated success of this program cannot be challenged.

My personal experience with the SBIR program is extensive. I have been involved with the high-technology small business community in both California and Virginia, and I have seen the value of the SBIR program in action. Over 20 years ago, several colleagues from the Stanford University and I formed a small entrepreneurial high-technology company in Sunnyvale, California. We were fortunate to receive several small business innovative technology grants from the Department of Defense prior to the establishment of the SBIR program that formed the mainstay of our high-technology product line. Through the 1980's, we competed for and won nearly a dozen SBIR Phase I awards with many subsequent Phase II awards. Many of the innovative technology products made possible by these SBIR awards were critical to our

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corporate success. These awards allowed us to attract the venture capital investments necessary to our continued growth. These SBIR awards served as a catalyst in support of our spectacular growth. Over a period of a few years, the SBIR allowed us to grow from a handful of technology entrepreneurs to an employment base of over 75 engineers and technical support personnel.

In the early 1990s, while a Research Professor at George Mason University in Fairfax, Virginia, I also served as Director of Small Business Programs. I was personally involved with over 100 small high-technology companies in the Washington, DC area, many located in the small business incubator program at George Mason. I worked with a number of these small businesses in their development of proposals to receive federal agency support through the SBIR program. I saw how critical the Phase I and Phase II awards were to the continuation of their entrepreneurial spirit. The relatively small investments made by the federal government through these SBIR program awards were often the key factor in attracting venture capital and achieving business success. Due primarily to these SBIR awards, several of these firms were able to attain the necessary critical mass of a viable product base and technical staff. The SBIR program allowed these firms to become thriving tax-paying businesses within the national capital area.

The importance of innovation to our nation cannot be underemphasized. Just a year ago, the Council on Competitiveness in conjunction with the Massachusetts Institute of Technology held the National Innovation Summit. Participants in the summit ranged from Members of Congress, the Vice President, university presidents, and industry executives. Summit participants concluded that:

> "... the country has made dramatic progress on the 1980s agenda of reducing costs, improving quality, shortening product cycle time, and putting the nation's financial house in order. But the stunning pace of global integration has created opportunities to produce standard goods and services in low-wage locations around the world. As a result, the competitive position of the U.S. economy hinges now more than ever on generating new ideas and translating them into products, processes, and services that command a premium in global markets and support high-wage jobs." [*Competing through Innovation: A Report of the National Innovation Summit*, March 1998]

As you know, SBIR was originally enacted in 1982 to increase the participation of small high-tech businesses in the federal research enterprise. Historically speaking, small businesses have provided greater innovation than larger companies. Unfortunately, such entrepreneurial businesses often did not have the resources to access the myriad number of research grant agencies within the federal government. For more than 15 years, the SBIR program has successfully addressed these issues through several simple underlying goals:

- Stimulate technological innovation
- Use small businesses to meet the research needs of the federal government
- Foster and encourage participation by minority and disadvantaged persons in technological innovation
- Provide greater commercialization of the fruits of federal research.

Mr. Chairman, I am pleased to report to you that based on my personal experience and those of other small business entrepreneurs that I deal with, the SBIR program is consistently meeting these goals. SBIR is contributing to technological innovation. Agencies are utilizing small businesses to meet their research needs. In addition, the fruits of federal research are being brought into the market place via small businesses.

The National Science Foundation (NSF), an initial participant in SBIR, has studied the effects of its own SBIR grants. It found that the top 50 successful small business grantees (representing about 10 percent of all Phase II grantees) account for $2.7 billion in direct sales and 10,000 jobs created. More remarkable is that NSF has only invested around $350 million since the SBIR program was created. That translates to a seven to one return on investment.

A special focus of the SBIR program has been to provide greater outreach to minority owned high technology businesses. The Small Business Administration (SBA) has found that approximately 10 per cent of all SBIR awards have consistently gone to minority owned companies. For example, of the 3,085 Phase I grants in FY95, 473 went to minority owned firms. It is clear that minority owned businesses are actively participating in the program and thus have access to the federal research establishment.

Technology transfer from federal research into the market place has been and continues to be a major concern in the research community. Ensuring that the fruits of federal research are realized is vital to the future economic well being of our nation. The SBA estimates that over 30 percent of Phase II projects will result in a commercialized product or service.

Our economy today is heavily invested in high technology. Though you may easily think of the large corporations such as Intel and Microsoft when you think high technology, you need also to consider companies like Combustion, Science and Engineering, Inc. in Columbia, Maryland. This very small high technology startup company is seeking real solutions to real problems. Its innovation is typical of many such companies across the United States and provides a useful illustration of the potential of the SBIR program. (I should note that the President of this firm is a member of the Society of Fire Protection Engineers, an AAES member society.)

In particular, this small business has recently submitted an SBIR proposal to the National Institutes of Health to develop a new smoke detector for hearing impaired people. Presently, smoke detectors for the hearing impaired have strobe lights on them. However, if the person is asleep this is not very effective. In its proposal, Combustion will work with students at Gaulludette University to develop a device the person could wear during sleep that would vibrate, much like many pagers used today. Part of the SBIR-funded research would focus on finding the optimum level of vibration needed to wake someone from a sound sleep.

Mr. Chairman and members of the Subcommittee, SBIR is indeed a successful federal program. I know you and your colleagues are as supportive of this program as much as I am. I look forward to seeing the SBIR continue to foster innovative technologies that will make the quality of life of all Americans better. Most importantly, SBIR will continue to strengthen our economy by providing critically necessary innovation and high-technology employment opportunities to the citizens of our nation.

Thank you.

U.S. SMALL BUSINESS ADMINISTRATION
WASHINGTON, D.C. 20416

TESTIMONY OF

DANIEL O. HILL

ASSISTANT ADMINISTRATOR FOR TECHNOLOGY

BEFORE

SUBCOMMITTEE ON GOVERNMENT PROGRAMS AND OVERSIGHT

COMMITTEE ON SMALL BUSINESS

U.S. HOUSE OF REPRESENTATIVES

MAY 27, 1999

Good morning, Mr. Chairman and members of the Subcommittee. Thank you for inviting me to appear before the Subcommittee on Government Programs and Oversight of the House Committee on Small Business to discuss the U.S. Small Business Administration's (SBA's) Small Business Innovation Research Program (SBIR) program. My name is Daniel O. Hill and I am the Assistant Administrator for the Office of Technology at the SBA. It has been my pleasure to manage the SBIR program for almost 4 years.

Numerous small businesses have been able to conduct successful research and development (R&D) through the SBIR program that they would not have been able to do alone. For example, before receiving a Department of Energy Phase II grant in 1991, the Atlantia Energy Corporation of Houston, Texas, constructed shallow water oil and gas drilling platforms. for about $2 million each. At the time, deep-water platforms built by others were so expensive ($500 million) that they were not economical to use for many small oil deposits. Atlantia used their SBIR grant to develop their new concept for deep-water platforms that would cost only $100 million. Four hundred construction workers were employed to build two of the platforms for a previous customer. The firm has grown from 30 to 100 employees as a result of the SBIR program and has received 4 patents and one trademark.

In addition, because the U.S. government receives royalties from the oil production, the two new platforms will send $200 million to the U.S. Treasury from fields that were previously not economically recoverable. Atlantia said they probably would not have undertaken the project without the SBIR award.

Today I will first, further discuss the need for and success of the SBIR program, second, give a brief description of the basics of the SBIR program and third, explain the role of the SBA in such success.

The Success of the SBIR program

The SBIR program was created in 1982 with the following objectives: "to strengthen the role of the small, innovative firms in federally funded research and development, and to utilize

federal research and development as a base for technological innovation to meet agency needs and to contribute to the growth and strength of the Nation's economy." I would like to elaborate on how the SBIR program meets these goals.

The SBIR program strengthens the small firm role in Federal R&D

By its design, the SBIR program strengthens the role of small innovative firms in Federally funded R&D. Since its first year of implementation, the SBIR program has grown to the point that it is now providing more than $1 billion a year to innovative small businesses. In spite of the effect of the SBIR program on Federal extramural R&D funding, small firms receive less than 5 percent of federal extramural R&D funding. This compares with about 47 percent going to large firms and more than 42 percent to universities and colleges (See Figure 1).

The SBIR program encourages Federal contracting with small innovative firms, which brings Federal spending more in line with the distribution of industrial R&D in the private sector. Small firms conduct more than 16 percent of the private sector R&D, yet they receive only 9 percent of the Federal R&D funds that go to private firms. The largest firms (those with 25,000+ employees), however, conduct about 46 percent of industrial R&D but they receive more than 80 percent of the federal R&D funds going to the industry.[1]

Recent data from the National Science Foundation (NSF) provide evidence that the small business role in innovation and the economy is likely to increase in the future. As we know, our economy is increasingly knowledge-based, where future competitiveness is determined by the quality of the human resource base of technically trained and skilled personnel. NSF data show that this human resource base, the technical intellectual capital needed for future innovation, appears to be moving from large business to small business. A recent NSF study concludes that "the employment of full-time equivalent research and development (R&D) scientists and engineers rose almost twice as fast between 1995 and 1996 at small companies as at larger ones --18 percent versus 10 percent -- according to a 1997 national survey of R&D-performing

1 NSF, Research and Development in Industry, 1997, early release tables

firms." [2] The data show this trend continuing from 1997 to 1998 with a 14 percent increase for small firms and only a 6 percent change for larger firms (See Figure 2). [3]

Another NSF survey shows that as many recent college graduates with degrees in science or engineering are entering small firms as large firms, and that this amount far exceeds the number going into other institutions such as universities, non-profits, or government (See Figure 3). [4] These data show that the SBIR program helps the Federal procurement process focus on a sector of the economy with a growing center of innovation capacity.

The SBIR program enables Federal agencies to meet their research needs

The ten Federal agencies in the SBIR program have very different research and development needs. Some seek the development of new products or processes to meet their program needs. Others focus more on building the research and science base in specific fields. The SBIR program has resulted in high quality research and development for the agencies. The flexibility in the program design has enabled agencies to manage their programs to effectively meet their specific mission objectives.

The SBIR program contributes to the growth and strength of the Nation's economy by increasing the commercialization of Federal R&D

Most evaluations of the SBIR program to date have focused on the success of participating firms in commercializing the results of their R&D.

- These reviews have documented the sales and additional R&D funds generated by SBIR firms. For example, a 1992 study by the General Accounting Office found that "the program is showing success in Phase III (commercialization) activity" and that SBIR expenditures of $956 million over 1984-1987 had generated $471 million in sales of new commercial products and $646 million in additional developmental funding as of July 1991.[5]

2 NSF, Will Small Business Become the Nation's Leading Employer of Graduates with Bachelor's Degrees in Science & Engineering?, 99-322, 1999 p. 2.

3 NSF, Research and Development in Industry, 1997, early release tables, Table A-52.

4 NSF, Will Small Business Become the Nation's Leading Employer of Graduates with Bachelor's Degrees in Science & Engineering?, 99-322, 1999 p. 3.

5 Results of a Three-Year Commercialization Study of the SBIR Program, U.S. Small Business Administration, 1991, (SBA 90-00.147).

- Studies by the Department of Defense in 1996 and the SBA in 1998, using the same methodology as GAO's and applying it to all SBIR agencies, found that the average Phase II SBIR project over 1984-1993 (funded at around $500,000) had generated $955,000 in sales and attracted about $625,000 in additional, non-SBIR funding as of 1998. The same study found that 55 percent of all respondents reported either sales or additional development funding or both.[6]

- A Harvard University study found that SBIR awardees grew significantly faster—whether measured by sales or employment—than a matched set of firms over a ten-year period. The study found this to be true in geographic areas with considerable venture capital activity.[7]

Analysts are quick to point out that any commercial success attributable to these projects adds value to the economy over and above the research they performed for the agency.[8]

The SBIR program contributes to the growth and strength of the Nation's economy by stimulating innovation

By making R&D funds available to small innovative firms, the SBIR program takes advantage of an underutilized economic and social resource: the small, flexible, innovative firm willing to take the risk needed to transform a new idea into an innovation. The term "innovation" generally refers to the introduction into the marketplace of a new product, process or service.

Studies and anecdotal evidence tell us that small firms have a number of advantages over large firms when it comes to innovation (greater flexibility, closer contact with customers and potential end users, greater willingness to engage in high risk R&D projects).[9] These qualities have made small firms the leaders in industrial innovation, producing more innovations per employee and per dollar spent on R&D than larger firms. In fact, large corporations in innovation-intensive industries try to achieve some of the advantages of small firm organization

6 BRTRC, Commercialization Small Business Innovation Research, and special tabulations, Peter Cahill, BRTRC.

7 Josh Lerner, 1996. The Government as Venture Capitalist: The long-run Impacts of the SBIR Program, NBER Working Paper 5753, Cambridge, MA.

8 This was a common comment by the participants of the National Academy of Sciences' Board on Science, Technology, and Economic Policy, Symposium on The Small Business Innovation Research Program: A Review of Current Research, May 5th 1999, Washington, D.C.

9 The State of Small Business, 1994 Chapter 3; and The State of Small Business 1996, Chapter 5.

through new business models using semi-autonomous research and business units. Further evidence of the advantage of small innovative firms is the important role being played by small start-up businesses in the development of emerging high-tech industries such as biotechnology and information technologies.

But the many advantages and efficiencies of small innovative firms are not fully realized in our economy because of the obstacles they naturally face in raising capital. Capital markets do not have the information needed to make sufficient investments in the high quality but risky small firm projects that can lead to significant and socially-beneficial innovations. The SBIR program funds those types of projects, by providing high-risk, patient capital that is not available in the market.

The impact of the SBIR program goes well beyond the outcomes of new product innovation and firm growth. At a recent symposium conducted by the National Academy of Sciences' Board on Science, Technology and Economic Policy, a team of researchers reported their findings from extensive case studies of SBIR recipients.[10] At the day-long conference, the researchers reported finding a number of examples of start-up firms that said they would not have started their company at all if it had not been for the SBIR program. In one study it was reported that fully half of the firms surveyed said that the existence of the SBIR program influenced their decision to start the company.[11]

In addition, a study has found that SBIR start-up firms have had the effect of encouraging colleagues to seek funding to start other firms. One-third of the firms in one case study said their SBIR experience had encouraged their colleagues to form their own innovation-oriented firms.[12]

There are also other indirect benefits of the SBIR program to the recipient firm. These indirect benefits include increasing staff skills, retaining or hiring valuable researchers,

10 National Academy of Sciences' Board on Science, Technology, and Economic Policy, Symposium on The Small Business Innovation Research Program: A Review of Current Research, May 5th 1999, Washington, D.C.

11 David Audretch, presentation of research, NAS Symposium on SBIR, op. cit.

12 David Audretch, op. cit.

increasing the credibility and financial stability of the firm, enabling new collaborative arrangements with others and influencing other R&D activities of the firm.

The SBIR program: Background

The SBIR program was created by the Small Business Innovation Development Act of 1982 (P. L. 97-219). The SBIR program mandates that each Federal agency with an extramural R&D budget in excess of $100 million must designate a certain percentage of this budget for awards to small businesses. Currently, there are ten Federal agencies participating in the program (See Figure 4).

In the early years of the program, the SBIR set-aside percentage was 0.2% of an agency's extramural R&D budget in excess of $100 million with a legislated growth to 1.25% in 1987 that continued until 1992. On October 28, 1992, the program was reauthorized through the year 2000 and Congress maintained the growth rate by directing that the percentage grow each year to an eventual 2.5% in FY 1997, maintaining that level to the year 2000.

The Act established a three-phase structure:

- Phase I: Awards of up to $100,000 are funded for six months for research projects to evaluate the scientific and technical merit and feasibility of an idea.
- Phase II: Funds Phase I projects with the most potential to further develop the proposed idea. Phase II funding is for one or two years, and most awards are $750,000 or less.
- Phase III: No SBIR funds may be used in Phase III. Private sector investment and support brings an innovation to market, and, if appropriate, Phase III may involve follow-up production contracts issued by a Federal agency for future use by the government.

SBA's Role in the SBIR program

In order to ensure the success of the SBIR program, the SBA plays a vital policy leadership role by seeing that the interests of small businesses are protected. The SBA directs the implementation and execution of the SBIR program by undertaking the following key management and policy functions:

- Issues policy directives to the participating federal agencies with specific instructions on establishing and maintaining the SBIR program at their respective agencies;
- Chairs quarterly interagency program managers' meetings to discuss policy initiatives and directions as well as operational issues;
- Provides advisory opinions on specific project and policy issues;
- Approves solicitation schedules for SBIR projects;
- Issues pre-solicitation information to small businesses;
- Collects program data (See Figure 5) and reports annually to the Congress and the Administration; and
- Maintains a database of SBIR winners and conducts studies to determine the success of the program.

Conclusion

In summary, the SBIR program is working; it is achieving its congressionally mandated goals. A large part of the SBIR program's success is clearly due to the skill, dedication, and ingenuity of the program managers and other Federal and state officials administering the program. I would like to commend them for the terrific work they do. Equally important is the unique and flexible design of the program, which enables it to fill the needs of a diverse set of Federal agencies, and at the same time, reach a broad range of small businesses. Finally, credit must go to the small businesses themselves who have performed so well in the program.

The SBIR program enables the Federal Government to keep pace with transformations in the economy while supporting a dynamic and innovative small business sector that will be the foundation of the economy of the 21st Century. The SBA supports the continuance of this successful program. Thank you for inviting me to discuss the SBIR program with you. I will be happy to answer any questions you might have.

Figure 1

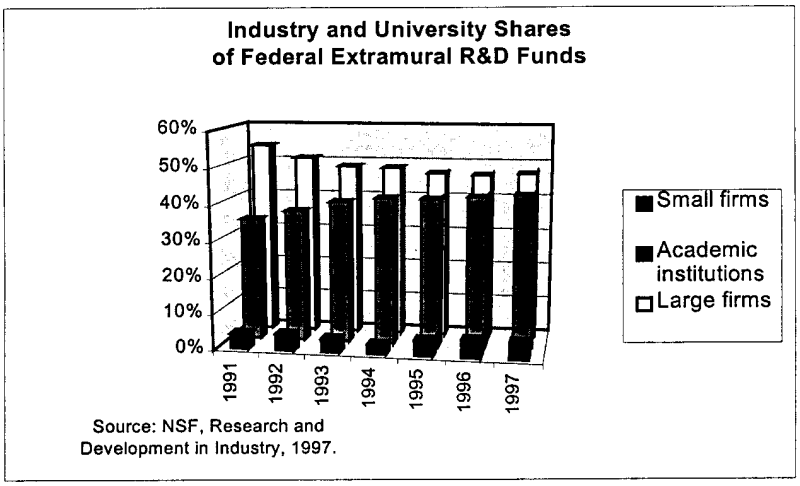

Figure 2

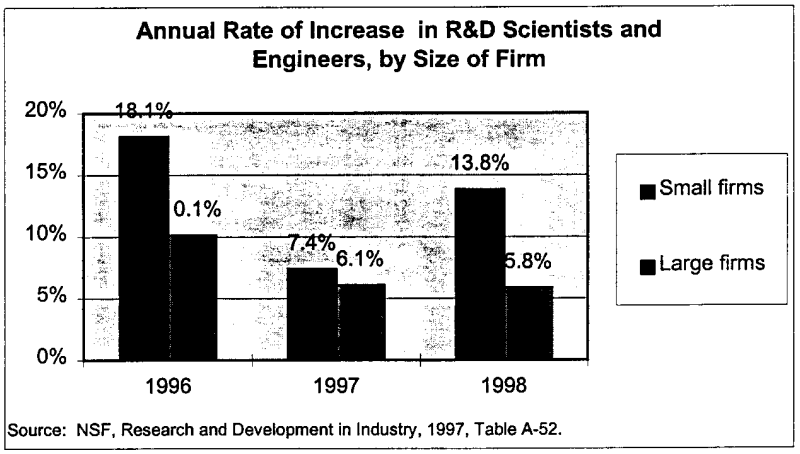

Figure 3

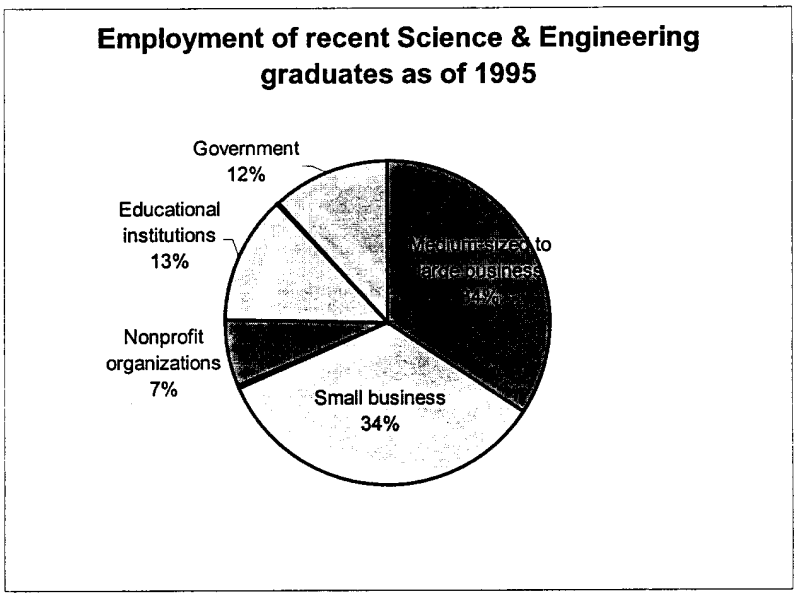
Employment of recent Science & Engineering graduates as of 1995
Government 12%
Educational institutions 13%
Nonprofit organizations 7%
Small business 34%

Figure 4

SBIR Agency Obligations
Fiscal Year 1997
(in thousands of dollars)

Department of Agriculture	10,020
Department of Commerce	7,330
Department of Defense	569,075
Department of Energy	74,872
Department of Transportation	8,370
Department of Education	4,470
Environmental Protection Agency	5,843
Health and Human Services	251,940
National Aeronautics and Space Administration	121,447
National Science Foundation	53,630
TOTAL	1,106,997

Figure 5

SBIR Awards
FY 1983 through FY 1998

	Number of SBIR Awards			Value of SBIR Awards (in millions of dollars)		
FY	Phase I	Phase II	Total	Phase I	Phase II	Total
83	686		686	44.5		44.5
84	999	338	1,337	48.0	60.4	108.4
85	1,397	407	1,804	69.1	130.0	199.1
86	1,945	564	2,509	98.5	199.4	297.9
87	2,189	768	2,957	109.6	240.9	350.5
88	2,013	711	2,724	101.9	248.9	389.1 *
89	2,137	749	2,886	107.7	321.7	431.9 *
90	2,346	837	3,183	118.1	341.8	460.7 *
91	2,553	788	3,341	127.9	335.9	483.1 *
92	2,559	916	3,475	127.9	371.2	508.4 *
93	2,898	1,141	4,039	154.0	490.7	698.0 *
94	3,102	928	4,030	220.4	473.6	717.6 *
95	3,085	1,263	4,348	232.2	601.9	834.5 *
96	2,841	1,191	4,032	228.9	645.8	916.3 *
97	3,371	1,404	4,775	227.6	789.1	1,106.9 *
98	3,022	1,320	4,342	262.3	804.4	1,066.7 (prelim.)

* includes award modifications

NEWS RELEASE

PRESS OFFICE

Release Date: May 26, 1999
Release No. 99-53

Contact: D.J. Caulfield (202) 205-6740
SBA News Releases: www.sba.gov/news/

SBA SEEKS R&D NOMINEES TO COMPETE FOR TIBBETTS TECHNOLOGY AWARD

WASHINGTON -- The U.S. Small Business Administration (SBA) is now accepting nominations for the Tibbetts Award, the agency's highest national technology recognition, which is presented annually. The award goes to individuals, small businesses and organizations involved with federal research and development through the SBA's Small Business Innovation Research (SBIR) Program.

"The Tibbetts Award offers national recognition to these 'models of technology excellence' and we're expecting an especially well-qualified pool of applicants this year," said SBA Administrator Aida Alvarez.

"In the past, the award has gone to firms like ORINCON of San Diego," added the Administrator. **"Using SBIR funding, this one company has developed products ranging from software for submarine tracking to a simple, low-cost alarm system for home swimming pools. SBIR makes 21st century technology available today."**

The SBIR program accounts for more than $1 billion per year in federal R&D funds and is coordinated by the SBA in cooperation with 10 other federal agencies. Details on the program and the award nomination process are available on the SBA's home page at www.sba.gov/sbir. Nomination packages are due in to SBA by July 15.

-more-

The SBA's award, named for Roland Tibbetts who spearheaded creation of the SBIR program, last year went to companies and individuals from every state in the nation. This year's presentation will take place in Washington, DC in October.

The small businesses receiving the Tibbetts award will be selected based on, among other considerations, the economic impact of the technological innovation, overall business achievement and demonstration of effective collaborations.

# # #

Testimony for

The U.S. House of Representatives
Committee on Small Business
Subcommittee on Government Programs and Oversight

Oversight and Reauthorization Hearing About SBIR -
Small Business Innovation Research Program

27 May 1999

Presented by:

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Chris W. Busch, SBIR Consultant, 27 May 99

Mr. Chairman and Members of the Subcommittee:

Thank you for the opportunity to testify at this Oversight and Reauthorization Hearing about the SBIR Program. My experience with the SBIR Program includes that of a former participating small businessperson, and currently as an agent of SBIR outreach in the northern Rocky Mountain states. I have strong convictions about the merits of the SBIR Program. The SBIR Program has special importance for the rural states, and I will focus my comments primarily on the issue of rural state small business participation in the SBIR Program competition.

1.0 MY SBIR OUTREACH ACTIVITIES AND BACKGROUND

My present work provides SBIR outreach support to rural state small businesses that aspire to compete successfully in the SBIR Program. My objective is to help them with all aspects of the competition process. My tasks include conveying information, developing and implementing competition strategies, reviewing their proposal preparation work, and providing guidance for their project management and commercialization activities. Over the last five years, I have worked primarily in the states of Idaho, Montana, North Dakota, South Dakota and Wyoming. Currently, I focus primarily on SBIR outreach work in Montana (through the Montana Department of Commerce) and Wyoming (through the University of Wyoming and the Wyoming Business Council). During my SBIR outreach work, I have witnessed many exciting success stories, and I will tell you about some of them later.

Prior to moving back to Montana and the northwest in 1993 where my wife and I have our roots, I worked in Orange County, California. I started a 100 percent employee owned small business (Spectron Development Laboratories, Inc.) there in 1975, sold it in 1986, and left the business five years later in 1991. The company

business was laser instrumentation and sensors. From the beginning of the SBIR Program in 1983 to 1986, our company received approximately 40 SBIR awards. These resources enabled us to develop R&D concepts into products for government agencies and the private sector. Simply put, the SBIR Program enabled our company to be successful and valuable.

Before starting Spectron Development Laboratories, I worked at Science Applications International Inc. (SAIC) (1971-1975) and TRW (1966-1971) in the Los Angeles area. My participation in government R&D business activities at these two companies provided an excellent entrepreneurial training ground for starting a business, competing for federal R&D resources, and capitalizing on the SBIR Program opportunity.

2.0 GENERAL COMMENTS ABOUT THE SBIR PROGRAM

Based on my experience with the SBIR Program at my small business, and through my SBIR outreach activities, I have strong convictions about the merits and value of this program. It is highly competitive, and only the highest quality proposals are awarded. Small businesses have established a convincing record that SBIR projects are a "good buy" for the federal government. There are many exciting SBIR success stories around our country.

The SBIR Program provides an excellent funding opportunity for small businesspersons that have a passion to explore, develop and commercialize their innovative ideas. We need to insure that the opportunities provided by the SBIR Program are kept open for our small businesses all across the nation well into the future.

Chris W. Busch, SBIR Consultant, 27 May 99

In order to compete successfully in the SBIR Program, small businesses must develop competitive skills and business disciplines. These assets help them to be competitive in the marketplace outside the SBIR arena. In this way, the SBIR Program provides an important training ground for entrepreneurs.

Many factors contribute to the success of the SBIR Program. The SBIR Program Managers at all the participating agencies the SBA SBIR Program staff have uncommon commitment to the success of the program. Their high quality is widely recognized in the small business community. They are very helpful to small businesses and state outreach personnel in providing assistance and help in many aspects of the SBIR competition process.

I believe a significant factor in the success of the SBIR Program is that it links small businesses directly with the federal agencies without intermediate agents. The SBIR resources go directly to small business entrepreneurs, the primary source of innovation and high quality jobs in our country.

The SBIR Program could not be successful without the many small businesses around the country that have converted SBIR resources into high quality jobs, and products and services for our country. I salute their entrepreneurial spirit, commitment and convictions, and I am proud of my history and present association with them.

Finally, the SBIR Program is fully dependent on the consistent actions of Congress that initiated the program, and continues to sustain and safeguard it. Thank you for making and keeping the SBIR Program a reality!!!

Chris W. Busch, SBIR Consultant, 27 May 99

3.0 THE SBIR PROGRAM AND RURAL STATES

Rural states have a special need for the technology-based businesses that the SBIR Program nurtures. These are the growth industries of the future that will enable aggressive economic development, and provide high quality job opportunities ***in these states*** for their young citizens and university graduates. We must do more to nurture these knowledge-based businesses in our states. The SBIR Program offers a unique (and frequently the only) opportunity for technology-based small businesses in rural states to access seed capital for exploring innovative ideas, and to start them on a path to realize their entrepreneurial dreams. The SBIR program is the only viable opportunity for most rural state small businesses to access federal R&D resources.

Based on my experience during the last five years performing SBIR outreach work in rural states, I am convinced that there are many more small businesses in these states qualified to compete and win in the SBIR competition than currently are doing so. These candidates come from many sectors, including university spinoffs, natural resource industries, "lone eagles" that move into the state, professionals returning to their native states, doctors, veterinarians, teachers and others. Yet many of them still have not heard about the SBIR Program. We need to do a better job of promoting the SBIR Program, especially in the rural states.

However, rural state small businesses frequently face real and significant barriers to successful competition in the SBIR Program compared to their counterparts in more industrialized areas. These barriers include lack of experience selling and performing R&D work for the federal government, usually long distance separation from the federal "customer" site, absence of networking with peers, and inadequate infrastructure support (e.g., technical writing and contract/grant and intellectual property management). These barriers often lead to a sequence of losses in SBIR competition for small businesses, and a decision to opt out of future

engagement with the programs. Effective SBIR outreach can change this scenario as I will discuss with you in a moment.

3.1 Rural State Performance in the SBIR Programs

As part of my SBIR outreach work, I have compiled the number of SBIR Phase 1 awards and proposals for each of the SBIR agencies and for each of the 50 states and Puerto Rico in Fiscal Year (FY) 1998. The data was provided by the SBIR agencies, and taken from agency SBIR websites. The agency SBIR personnel have been very helpful in compiling this information.

The awards are those that resulted from proposals submitted during FY 1998 for all the SBIR agencies except NIH. For NIH, the number of awards are those that began in FY 1998, and the number of proposals is the set used as the base for selecting the awards.

Based on this compilation, Table 1 (page 8) shows the FY 1998 award and proposal numbers for each of the SBIR agencies, and for the Nation, the NSF EPSCoR region, and a 5-state region. (EPSCoR is the Experimental Program to Stimulate Competitive Research.) The cumulative totals for all agencies in each of the regions are also presented. In addition, data for FY 1997 are also presented in Table 1 for the Nation and the 5-state region - data for the EPSCoR region was not compiled for 1997.

The EPSCoR and 5-State regions are defined immediately below. The EPSCoR region used in the compilations is the NSF EPSCoR Region (other agency EPSCoR regions may differ slightly):

EPSCoR Region:	AL, AR, ID, KS, KY, LA, ME, MS, MT, ND, NE, NV, OK, PR, SC, SD, VT, WV, WY
5-State Region:	ID, MT, ND, SD, WY

Two definitions of column titles used in Table 1 are provided below:

"Awd % of Props"	Awards in the region as a percent of proposals submitted from the region.
"Awd % of Tot Awd"	Awards in the region as a percent of total awards in the nation.

While I have tried my best to be diligent in managing and compiling the data, there may be errors. However, I am confident that any errors are not significant.

Agency Abbreviations used in Table 1 and subsequent text:

EPA	Environmental Protection Agency
NASA	National Aeronautics and Space Administration
NIH	National Institutes of Health
NSF	National Science Foundation

3.2 Some Observations about the Data in Table 1

A cursory look at the data in Table 1 for 1997 and 1998 shows significant variations in the numbers between the two years. This suggests caution in concluding too much from this data for any single year.

Table 1: FY 1998 SBIR Competition Results

FY 1998 SBIR Competition Results

AGENCY	NATION (Total)			EPSCOR REGION				5-STATE REGION			
	Awards	Proposals	Awds % of Props	Awards	Proposals	Awd % of Props	Awd % Tot Awd	Awards	Proposals	Awd % of Props	Awd % Tot Awd
Agriculture	77	420	18.3	20	96	20.8	25.97	5	39	12.8	6.5
Commerce	45	374	12.0	6	23	26.1	13.33	0	3	0.0	0.0
Defense	1257	9120	13.8	48	468	10.3	3.82	5	48	10.4	0.4
Education	41	231	17.7	2	13	15.4	4.88	1	3	33.3	2.4
Energy	198	1190	16.6	12	71	16.9	6.06	2	18	11.1	1.0
EPA	37	321	11.5	2	27	7.4	5.41	1	8	12.5	2.7
NASA	345	2335	14.8	27	152	17.8	7.83	2	22	9.1	0.6
NIH	692	2432	28.5	25	129	19.4	3.61	7	35	20.0	1.0
NSF	235	1598	14.7	22	107	20.6	9.36	7	29	24.1	3.0
Transportation	21	246	8.5	2	14	14.3	9.52	0	4	0.0	0.0
Totals	2948	18267	16.1	166	1100	15.1	5.63	30	209	14.4	1.0

FY 1997 SBIR Competition Results

AGENCY	NATION (Total)			EPSCOR REGION				5-STATE REGION			
	Awards	Proposals	Awds % of Props	Awards	Proposals	Awd % of Props	Awd % Tot Awd	Awards	Proposals	Awd % of Props	Awd % Tot Awd
Agriculture	72	401	18.0	(Data not compiled)				6	40	15.0	8.3
Commerce	63	327	19.3					2	3	66.7	3.2
Defense	1178	9552	12.3					1	52	1.9	0.1
Education	50	260	19.2					0	5	0.0	0.0
Energy	202	1225	16.5					0	17	0.0	0.0
EPA	35	393	8.9					0	5	0.0	0.0
NASA	335	2665	12.6					1	29	3.4	0.3
NIH	729	2527	28.8					4	28	14.3	0.5
NSF	215	1631	13.2					6	24	25.0	2.8
Transportation	29	298	9.7					1	6	16.7	3.4
Totals	2908	19279	15.1					21	209	10.0	0.7

Overall, the "win rates" (awards as a percent of proposals submitted, Table 1, second last column) in the 5-state region for both 1997 and 1998 are on par with the national averages (slightly lower in 1997). This is true as well for the EPSCoR region in 1998. Hence, the overall data suggest that a primary avenue for achieving more awards in these regions is to submit more proposals. A vigorous and effective SBIR outreach activity in these regions will enable this result. The outreach activity must convey information about the program, encourage participation and nurture confidence, and provide assistance in all aspects of the SBIR competition process

Generally, rural state small businesses have more success competing in "peer review" agencies than in "line review" agencies. In "peer review" agencies (e.g., Agriculture, NSF and NIH) the SBIR proposal evaluations are performed by independent third parties. In "line review" agencies (e.g., Defense and NASA), the proposal evaluations generally are performed by the agency line management personnel. At the line review agencies, relationships with personnel cognizant about specific topics is highly beneficial in order to understand the agency end use for SBIR work to be performed, and hence to submit a more responsive proposal.

As shown in Table 1, the highest "win rates" (second last column) in the EPSCoR and 5-state region include the "peer review" agencies (Agriculture, NIH, and NSF). In these regions, the "awards as a percent of total awards" (Table 1, last column) is consistently high at Agriculture, good at NSF, and relatively low at NIH. As the NIH opportunity is conveyed to small businesses in the EPSCoR and rural states through effective outreach activities, I believe these regions will claim a larger fraction of the total NIH awards.

At the "line review" agencies (e.g., Defense and NASA), the competition is tougher for small businesses in the 5-state region. The "win rate" (awards as a percent of proposals submitted, Table 1, second last column) for Defense and NASA were

very low in 1997, but improved in 1998. We hope this is a trend and not an anomaly. In addition, the "awards as a percent of total awards" (last column, Table 1), is low in both 1997 and 1998 in the 5-state region. These data reflect the difficulty rural state small businesses have in establishing relationships with cognizant personnel at "line review" agencies.

A consistent record of submitting losing proposals will cause small businesses to opt out of competition at that agency, and they will turn to those agencies where they are more successful. An effective outreach activity is needed to improve rural state competition at the "line review" agencies.

4.0 RESULTS OF SBIR OUTREACH IN RURAL STATES

4.1 The Wyoming SBIR Initiative

The Wyoming SBIR Initiative began in mid-1996 with the goal of increasing the number of SBIR awards to Wyoming small businesses. I have had the privilege to serve this activity since its beginning along with other fully committed state and university employees and volunteer private citizens. The Wyoming SBIR Initiative was funded for the first two years by the State of Wyoming and NSF EPSCoR Program (Experimental Program to Stimulate Competitive Research). Since September 1998, it has been supported by the University of Wyoming and the Wyoming Business Council (WBC). The WBC support includes $125,000 for outreach personnel and expenses, and $120,000 for a competitive Phase 0 program that aims to position small businesses to capture an SBIR Phase 1 award.

The Wyoming SBIR Initiative is a multi-faceted approach to SBIR outreach. Activities include periodic workshops around the state, a weekly email newsletter,

and extensive one-on-one interactions between persons knowledgeable about the SBIR competition process and candidate SBIR participants. On 4 August 1998 a Wyoming SBIR Conference was held and attended by about 120 persons and 7 federal SBIR agency personnel.

The Wyoming SBIR Initiative has led to substantial gains in both the number of proposals submitted, the quality of proposals submitted, and the number selected for award. The improved SBIR performance by Wyoming small businesses is illustrated in Figure 1 below that shows the acceleration in the number of SBIR Phase 1 awards since its first award in 1987. The total number of awards from the beginning of the SBIR Program through 1995 was eight. There were eight Phase 1 awards in 1998 alone, and already in CY 1999, Wyoming small businesses have captured 11 Phase 1 awards. We believe this is conclusive evidence that effective SBIR outreach leads to improved SBIR competition performance in rural states.

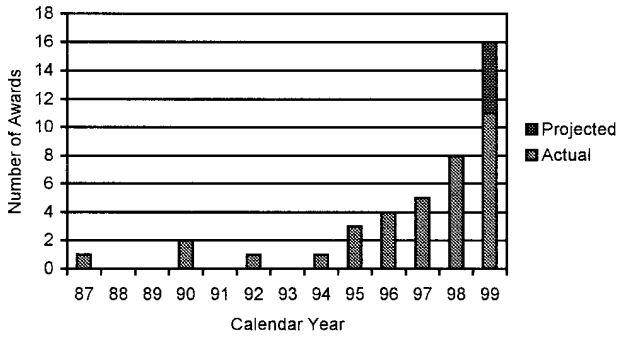

Figure 1: Annual Number of Wyoming SBIR Phase 1 Awards

But there is more work to be done in Wyoming SBIR competition. Improved Phase 2 capture rate, broader geographic distribution of awards in the state, and better commercialization results are all goals that we are striving to attain. These will be achieved through an SBIR outreach activity performed in concert with Wyoming state resources and small businesses, and partnerships with U.S. SBA and federal SBIR agencies.

Other states have implemented SBIR outreach activities as well, and they too have demonstrated significantly improved performance in SBIR competition. A notable example is the State of Maine.

4.2 National SBIR Conference in Billings, MT, 16-19 May 99

Last week (16-19 May 1999), the National Science Foundation (NSF) sponsored a National SBIR Conference in Billings, MT, in cooperation with SBA, the Department of Defense, and all of the federal SBIR agencies. The conference was organized under the leadership of Dr. Kesh Narayanan, NSF. Approximately 30 SBIR agency personnel participated, and all 10 SBIR agencies were represented. The conference theme was SBIR Competition in Rural States. Approximately 450 persons attended the conference from across the country, far exceeding early expectations.

The conference generated an excitement among small businesses in attendance, and many of them were exposed to the SBIR Program for the first time. However, early follow-up by these participants and effective outreach support is vital to their successful competition and participation in the SBIR Program.

4.3 SBA SBIR Outreach Program

Through an amendment offered by Senator Conrad Burns (R-MT), Public Law 105-135, Section 501, authorized the U.S. Small Business Administration (SBA) to provide up to $100,000 annually to eligible states for outreach to small businesses. Eligible states are those that underperform in capturing SBIR award resources. An amount of $1,000,000 was appropriated for this purpose just before the close of the 105th session of congress. The legislation requires a 50 percent match by participating states. An SBA solicitation implementing this program closed to proposals on 17 May 1999. Based on my discussions with cognizant persons in eligible states around the country, there is high interest in the SBA SBIR Outreach Program. This program will provide vital resources to eligible states, and help these states provide SBIR outreach.

4.4 The Role of Federal Agencies in SBIR Outreach

Federal agencies are vital partners in effective SBIR outreach. Agency SBIR Program Managers can convey uniquely to prospective SBIR competitors insights into the SBIR competition process. After a Phase 1 award is made, these agency personnel can provide critical guidance to prepare the small businesses for Phase 2 and commercialization.

National, regional and state SBIR conferences are prime examples where agency personnel play a key role in SBIR outreach. These conferences are excellent forums for small businesses to become oriented to the many opportunities within the SBIR Program, to learn about the competition process, and to establish relationships with agency personnel. These conferences would be hollow without the participation of the SBIR agency personnel engaged in the SBIR Program on a daily basis.

At the National SBIR Conference in Billings, MT, 16-19 May 1999 cited above, approximately 30 federal agency personnel attended and participated in the proceedings. The opportunity to interact with these SBIR representatives provided small businesses unique insights into the SBIR Program through "one-on-one" meetings and other networking events. At the same time, agency personnel received valuable information on the talents and resources of small businesses that may help fulfill agency needs and requirements under the SBIR Program.

Another important outreach activity by SBIR Program Managers is site visits to SBIR winners. Through site visits, the SBIR winners are able to gain valuable insights into the operation of the SBIR Program at the federal agency that has made the award and to gain a better understanding of the factors that contribute to success in Phase 2 and subsequent commercialization. The SBIR Program Managers also benefit by gaining a better understanding of the small businesses and the R&D projects being supported.

4.5 The NSF EPSCOR SBIR Proposal Funding Model

EPSCoR is the Experimental Program to Stimulate Competitive Research. The National Science Foundation (NSF) EPSCoR has developed a highly effective SBIR proposal funding initiative in conjunction with the NSF SBIR Program Office. NSF and other SBIR agencies have a significant number of high quality proposals that normally are not funded because of limited funds. Through the NSF EPSCoR and SBIR Program initiative, the NSF EPSCoR Program provides funding for a select number of these high quality SBIR proposals from EPSCoR states that fall below the "pay line" with NSF SBIR Program funds. Even though the funds come from the NSF EPSCoR Program, the awards are made through the NSF SBIR Program Office. Through this initiative, only high quality proposals from EPSCoR states are funded that would otherwise not be. The awards are based on a competitive

selection process, and not on an "entitlement" or quota system. The NSF EPSCoR Program has funded 82 Phase 1 SBIR awards valued at over $7 million since 1984, according to NSF.

Winning the first SBIR award is usually the hardest for small businesses. The NSF EPSCoR funding mechanism provides an assist to EPSCoR state small businesses by helping them over this initial hurdle. Many small businesses in the region where I work have benefited from this initiative. With this assistance, they have gone on to compete successfully in NSF (without EPSCoR support) and at other agency SBIR Programs.

The NSF EPSCoR Program practice of funding qualified SBIR proposals from EPSCoR states is an excellent way to engage small businesses in these states in the SBIR Program. I believe it should be emulated in an appropriate form at other SBIR agencies, especially at those SBIR agencies where rural state small businesses find it difficult to compete successfully.

4.6 SBIR Winners and Candidates in Rural States

There are many exciting SBIR success stories emerging in rural states. Eleven of them were showcased at the National SBIR Conference in Billings, MT, 16-19 May 1999, in a session called "Role Models" (see Section 4.2 above). They included new companies started by university graduates, relatively mature businesses that have created commercial products and quality jobs with SBIR resources, and natural resource businesses that have used SBIR awards to develop high value-added products that created new opportunities for their employees. All of them are driven by the entrepreneurial spirit and share an excitement about the SBIR opportunity. Several of them didn't know about the SBIR Program only a few years ago.

Chris W. Busch, SBIR Consultant, 27 May 99

As I continue my SBIR outreach work, I find excellent new candidates who have not heard about the SBIR Program. Many of the companies we discover and "reach out" to today will be SBIR winners and role models tomorrow.

5.0 RECOMMENDATIONS FOR THE SBIR PROGRAM

5.1 SBIR Reauthorization

The SBIR Program is vital to America's small businesses, especially in rural states. Give highest priority to its reauthorization in this session of Congress.

5.2 Continue and Expand the SBA SBIR Outreach Program

I strongly recommend that the SBA SBIR Outreach Program be continued and that federal funding for eligible states be increased to a maximum of $200,000 annually, and that the 50 percent state match requirement be retained. This will provide up to $300,000 in annual funding for each eligible state, and enable an effective SBIR Outreach Program. Provide adequate resources for SBA to participate in the SBIR outreach activity. Establish a rational basis for establishing qualified states.

The program should continue to be competitive to insure implementation of high quality SBIR Outreach Programs in participating states. If the program becomes an entitlement for eligible states, the quality of SBIR outreach provided will be degraded. Competition is a cornerstone of the SBIR Program, and it must be so for the SBA SBIR Outreach Program as well to insure its success.

5.3 Provide Resources for Agency SBIR Outreach

The federal agency SBIR personnel are vital partners for effective SBIR outreach. Therefore, I recommend that a portion of the SBIR Program funds at each of the 10 participating agencies be devoted to SBIR outreach and assistance. A major part of the SBIR outreach resources should be focused in states eligible for the SBA SBIR Outreach Program (see 5.2 above).

5.4 Encourage the NSF EPSCOR SBIR Proposal Funding Model at other Agencies

Encourage SBIR agencies to implement a program similar to the NSF EPSCoR SBIR Proposal funding model by providing funding for high quality proposals from underperforming regions that fall below the "pay line" in the normal SBIR competition. This will engage small businesses in these regions in the SBIR Program competition and help them over the initial competition barrier.

5.5 Establish a Uniform Method for Calculating "Extramural Budget"

Establish a uniform and consistent method for agencies participating in the SBIR Program to calculate their "extramural budget" in determining their SBIR allocations.

6.0 CLOSING COMMENTS

The SBIR Program is vital to nourishing technology-based small businesses in our country. These businesses are the engines for future economic growth and for the creation of high quality job opportunities. The SBIR Program is indeed a "good buy" for the sponsoring agencies and America.

There is a special need for technology-based small businesses in rural states as they struggle to transition into twenty-first century economic realities. The SBIR Program is a unique enabling resource toward this end. These small businesses will provide in-state career opportunities for young citizens and university graduates, stem the outward migration of intellectual talent, and provide the foundation for the economy of the future in these states. The SBIR Program already is making significant and measurable contributions in these states. However, I believe strongly that we must do more to enable competitive access to SBIR resources for rural state small businesses.

Small businesses in rural states are competing successfully in the SBIR Program. Yet, there are many excellent candidates for SBIR competition in rural states that have either not heard about the SBIR Program, or have not yet elected to participate. My experience is that an effective SBIR outreach program will engage many of these small businesses in successful SBIR competition. This requires a team approach to SBIR outreach that includes federal agency and state outreach personnel.

I appreciate the opportunity to testify at this hearing, and thank you for your support for the SBIR Program.

Thank you.

COMMENTARY OF
ROBERT M. PAP
PRESIDENT & CEO
OF
ACCURATE AUTOMATION CORPORATION

BEFORE THE COMMITTEE ON SMALL BUSINESS
U.S. HOUSE OF REPRESENTATIVES
ON THE
SMALL BUSINESS INNOVATION
& TECHNOLOGY TRANSFER RESEARCH
MAY 26, 1999

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Mr. Chairman and members of the committee, it is my pleasure to present this statement about our experience and knowledge of the Small Business Innovation Research and Small Business Technology Transfer Research programs. This will allow the Congress an opportunity to review the success of these programs as well as to frame future changes to the legislation to meet the proposed technology needs for America in the next millennia. As a result of this committee's efforts, the American people have two very successful government programs in the Small Business Innovation Research (SBIR) and the Small Business Technology Transfer Research (STTR) programs. As one of the individuals who suggested the STTR concept in 1991, I want to commend the committee on this great program.

I am the *president* and *chief executive officer* of Accurate Automation Corporation, a Chattanooga, Tennessee based company that has been doing advanced research under the SBIR program since 1988. I am also a member of the Board of Directors for the State of Tennessee Technology Development Corporation, appointed by our Republican Governor (and your former colleague) Don Sundquist. I was a delegate to the 1995 White House Conference on Small Business, where I served as the technology chairman from Tennessee. I was selected *Tennessee Small Business Person of the Year in 1997* by the Small Business Administration.

Accurate Automation won the first SBIR proposal that it submitted and was fortunate to win one of the first STTR contracts awarded from the Department of Defense. The United States Navy awarded us with both a Phase I and Phase II. Accurate Automation has firsthand experience and knowledge in the performance of this Act, its benefits, its people, agencies, and the progress of this very important program. We have been addressing one of the critical technologies in this project, and a patent has been applied for. The Office of Naval Research, under the technical direction of Dr. Joel Davis (for Vincent D. Schaper, Douglas Harry and John William) is the sponsor of the sensor fusion (one of the critical technologies) work. I hope that this information will provide you with a better knowledge of our experience under the Small Business Technology Transfer Research program as defined in 15 USC 638 and Public Law 102-564 Title II.

SBIR and STTR BACKGROUND

The concept of the Small Business Innovation Research program originated from the National Science Foundation in 1977. The program was piloted with a one year experiment (In 1981 the NSF made 85 awards under 42 U.S.C. 1861.) that validated the concept for what became the Public Law 97-219, which was enacted on July 22nd, 1982, as today's Small Business Innovation Research program. The SBIR program that became law was reauthorized in 1986 and 1992. In 1982 the Department of Defense sponsored the Defense Small Business Advanced Technology or DESAT program that preceded the fiscal year 1983 introduction of the Small Business Innovation Research program in 12 federal agencies.

The Small Business Technology Transfer Research (STTR) program became part of the core small business technology funding mechanism, with the 1992 reauthorization (Public Law 102-564), developed by this committee working with the Science and Defense Committees of the House and their counterparts in the Senate, and with unanimous consent from all of the members in both houses of Congress. This pilot program has given the American small business community an opportunity to work with the National Labs, FFRDCs and universities, to better interact and provide jobs based upon technology developments and developing new intellectual property.

The SBIR and STTR programs truly stand as crown jewels for technology development, and in keeping America technologically competitive. The NSF 1997 *R&D in Industry Report* projects that the United States Government appears to be lagging behind the private sector in recognizing the R&D capabilities of small firms. I believe that the Congress and SBA will support the SBIR & STTR programs so that technology can remain strong.

While "angels" fund 30,000 companies, they provide very limited long duration or patient financing that addresses the capital needs of a high tech firm. The SBIR and STTR, therefore, are unique. I have first-hand knowledge of the difficulties met in finding financing, knowledge which I gained when I started Accurate Automation.

While Business Incubators are great for startups, they do not address the entrepreneurial spirit and technology interaction that is needed in real cutting edge

research. We need a "Technology Tank" which is exactly what the government sponsor brings to the project. This is the difference between university research and SBIR and STTR projects. Not only is the capital vital, but the technological interaction is a very essential part to the successful American R&D firm. These components are needed to provide job creation in a time of large Corporate American downsizing. The actual intellectual interaction with some of the top researchers, as a result of the SBIR and STTR, in this early stage funding, is allowing startup businesses to survive, prosper, and grow into the future successful IPOs we see going public.

Today, America High Technology Small Businesses are no longer unique as the rest of the world catches up with us. In the current issue of Harvard Business Review (May/June 1997), Professor Iansiti and West observe, "At the same time, the sources of new technology have proliferated. Graduates from leading universities populate the R&D organizations of companies all over the world." In our industry, both Taiwan and Hong Kong are doing cutting edge neural network research and they are creating startups that I have visited during my travels abroad. In aviation products, we met a number of people looking at similar technologies inside the NATO community.

ACCURATE AUTOMATION BACKGROUND

Accurate Automation Corporation is an aerospace/computer systems company doing research & development in hypersonic aircraft design and development, as well as in the emerging computational technology of neural networks. We have received 45 SBIR Phase I awards and 25 SBIR Phase II awards to-date. In addition, we have had over fifty Phase IIIs worth over $15,000,000. We have commercialized our neural network technology through high performance computer boards and licensed software that is used on personal computers, aircraft avionics, High Performance 3-D Workstations and Project Supercomputers. We have filed applications for six patents in order to protect our intellectual property.

Accurate Automation's anticipated 1997 sales (including the Phase IIIs) will be nearly $8,000,000. Our revenues have steadily increased over the years, $188,000 in 1989, $470,000 in 1990, $880,000 in 1991, and over $4,000,000 in 1998. Our hypersonics research has the capability to revolutionize future aircraft. Our Neural Network Toolbox (NNT®) will be shipped on thousands of high

performance graphics workstations and project supercomputers. With each payment by the government to Accurate Automation, our associated payroll puts nearly 17% of revenue back into the U. S. Treasury almost immediately. The profit from our technology transfer brings additional revenue back to the U. S. Treasury in taxes.

The SBIR program has allowed Accurate Automation to grow from a two-person company (started in 1988) located in a 450 square foot office in the basement of a Sheraton Hotel in downtown Chattanooga. Today the company has thirty-three employees and five consultants occupying 13,000 square feet of a 21,000 square foot facility. We work with universities such as Wake Forest, University of Maryland, Stevens Institute of Technology, Worcester Polytechnic Institute, Texas Tech, Georgia Tech, Tennessee Tech and the Naval Postgraduate School. We work with major corporations like Lockheed Martin, Boeing, AMTEC, B.F. Goodrich and Silicon Graphics.

Our SBIR and STTR neural network projects are highly innovative and contribute to keeping the United States ahead of Japan and Europe in these technologies. These projects have led to the development of the Neural Network Processor (NNP®) which is the only Multiple Instruction/Multiple Data Neural Net hardware on the market. Our Neural Network Tools (NNT®) is a world class library of neural network tools.

Under the Office of Naval Research STTR, we have designed a biologically inspired sensor fusion computer for improving the signal processing hardware. We have a patent on this technology. There is a large market for this product. This patentable technology is one of the critical technologies. The neural network technology being developed at Accurate Automation Corporation is directly related to the Critical Technology Plan, as reported to the Congress by the Department of Defense and Department of Commerce. Without the SBIR program, our technical success and growth as a company would not have taken place.

We are finding that the agencies are not paying attention to the critical technologies aspect as spelled out in 15USC 638. This is an area that needs to be addressed through formal requests to the agencies on the present topics in their solicitation. Some of the agencies have now built layer upon layer of review into their program and the creativity is being filtered by each layer of review. The topic

sponsor, who is the expert, is moved further away from the really creative idea as more people with less unique knowledge review the proposals.

SBIR PROJECT EXPERIENCE

Accurate Automation's experience in the SBIR program includes dealing with the Navy for advanced air traffic control systems. This was our first SBIR, and responded to a requirement from the Naval Air System Command (PMA-213). It was our first SBIR Phase II. This project was managed by the then Naval Ocean Systems Center (now NRaD) in San Diego, CA. This project resulted in a new technology for reducing radar clutter and processing data from multiple sensors on an aircraft carrier or amphibious assault ship. We were awarded a Phase III effort for the Navy as a result. This technology provides new signal processing and data collection technology.

Accurate Automation has received a number of Phase II SBIRs from NASA Langley Research Center, the Air Force Wright Labs and the Office of Naval Research, to fund the development of a hypersonic aircraft known as a "Waverider" under a program called "LoFLYTE®" for Low Observable Flight Test Experiment. This project will provide revolutionary flight controls for all types of aircraft. We are developing an advanced air data subsystem for all types of aircraft. This program has been covered by *Aviation Week*, *Popular Mechanics*, *Avionics Magazine*, *New Technology Week* and even the *London Sunday Times*. This SBIR program also has given us the opportunity to provide innovations in hypersonics and help return the United States to its rightful stature and help to correct our balance of trade deficit. We are now negotiating with major corporations on this technology.

NEURAL NETWORKS

The SBIR programs in the various agencies have funded a number of researchers in the area of neural networks. The European and Japanese research communities have been investing heavily to catch up with the United States. If it were not for the SBIR investment in neural network technology to fulfill a variety of needs, as outlined by DoE, DoD, NSF, DOT, and NIH, they would probably have caught up with our country already. If the SBIR investment is not included in the totals, the Europeans are outspending the United States. In addition, the SBIR program is driving companies like Accurate Automation to commercialize

the results of the research and getting us into the marketplace ahead of the rest of the world.

HYPERSONICS

Accurate Automation is the prime contractor, under SBIR funding, on the joint USAF/NASA LoFLYTE® program. LoFLYTE® is a Mach 5 waverider aircraft being flown at Edward's Air Force Base, under the Small Business Innovation Research program, as a subscale subsonic demonstrator. LoFLYTE® is flying at Edwards AFB under a neural actuator designed by Accurate Automation. The goal of the LoFLYTE® program is to:

- develop a subsonic database on the Mach 5 waverider design,
- determine its landing and takeoff characteristics, and
- serve as a testbed for a number of advanced aircraft technologies including:
  - a neural actuator control system,
  - a neural network stability augmentation system,
  - a fly-by-light communications protocol,
  - a neural air data sensor,
  - a neural network based pilot induced oscillation detection and amelioration system,
  - advanced hypersonic flowpath technology, and
  - neural network non-destructive evaluation techniques for both composites and titanium aircraft components.

This aircraft is a jet powered Remotely Piloted Vehicle (RPV) 100 inches in length. The flight tests are providing valuable information about the performance of a hypersonic shape in a subsonic regime which will be used to optimize the design of LoFLYTE®'s neural flight control system. The LoFLYTE® vehicle's aerodynamic characteristics have been evaluated based upon wind and water tunnel data and 6 degree of freedom simulations. This shape was inversely derived from a Mach 5 conical flowfield. An initial concept for LoFLYTE® was generated and then tested in the 12ft. and 30ft. by 60 ft. wind tunnels at NASA Langley Research Center.

The 100 inch LoFLYTE® body is a semimonocoque sandwich structure with a medium density foam core covered by a fiberglass cloth. This composite body is designed for loads at 200% of those anticipated.

One of the primary goals of the LoFLYTE® program is to serve as a flying testbed for a neural flight control system. Our neural flight control system has two innovative elements.

- an adaptive actuator/control surface controller, and
- a learning/adaptive Stability Augmentation System (SAS) designed with neural network and reinforcement learning techniques.

As the program progresses, the control system now includes autonomous elements, such as automatic landing.

Neural networks are a class of algorithms based loosely on the way nervous systems work. Neural networks have the potential to improve flight control systems in many ways. These improvements can be divided into the following classes:

1. Neural networks offer a way to incorporate pilot flight abilities into a flight control system. They also offer a way to incorporate qualitative performance feedback into a control system in an automated manner.
2. Neural networks have the potential to increase the complexity of flight control systems while maintaining tight loops.
3. Neural networks can smoothly approximate lookup tables of parameters.
4. Neural networks represent a potential for adding to flight control systems capabilities which are not readily solvable by conventional means.
5. Neural networks offer the potential of capabilities such as self-parameterization, or "learning," during flight.
6. Neural networks can be used to implement fault tolerant controls, which autonomously reconfigure themselves in flight to compensate for aircraft damage and system failures.

LoFLYTE® completed its first flight on Dec 16, 1996, at the Mojave Airport in Calif. It is operated by Accurate Automation under bailment from the U.S. Air Force based at the Air Force Flight Test Center, 419th Flight Test Squadron at Edward's Air Force Base in California. The aircraft is in flight test today. These flights are the first free flights of a Mach 5 Waverider shape

utilizing a micro-turbine engine utilizing unique tiperon control. Nose camera video provides down link data, utilizing spread spectrum telemetry. These flights are the first known flights of a single expansion ramp nozzle (SERN) taking off from a runway and then landing. The SERN performance demonstrated some original concerns from the NASP program in hypersonic nozzle design. Future flights will test data link functionality, including transmission of real time images, GPS/INS navigation and instrumentation, neural net flight control, neural air data sensor smart skin technology, advanced fly-by-light and hypersonic envelope expansion.

CONCLUSIONS

Accurate Automation has followed the intent of the SMALL BUSINESS INNOVATION RESEARCH and SMALL BUSINESS TECHNOLOGY TRANSFER RESEARCH PROGRAMS in Public Law 102-564. We have developed new technology in an exciting new field, grown as a company and commercialized government research through the development of Phase III licenses.

The STTR and SBIR programs are part of a requirement based system that addresses the issue as stated in the Harvard Business Review Technology Integration Article by Iansisti and West that "Discovering new technologies was not enough. Successful companies were those most adept at choosing technologies that would work together in an increasingly complex production system." In an era of corporate downsizing and less investment in research by major corporations, the SBIR and STTR program provide jobs, ideas, innovations, new product, and have stimulated the economy in a way that cannot be found in most major corporations. This is becoming obvious with the purchases of SBIR companies by major corporations and with successful IPOs of SBIR companies.

Accurate Automation's growth, and the growth of other SBIR and STTR companies, which far exceed ours, is testimony to the success of these programs. With the research and development tax law revision in the late 1980s and the current lack of early seed capital, the opportunity for venture capital and support for technological development has all but dried up in America. Your insight in 1982, 1986 and 1992 in the creation and renewal of the Small Business Innovation Development Act has become vital to American innovation, which is now

centered in small high technology businesses like Accurate Automation Corporation.

Through our participation in the SBIR and STTR programs we have been able to circumvent the all too well known scenario of being invented in America, but commercialized by others. This is Accurate Automation's effort to fulfill the SBIR and STTR mandate to be a 'counterforce to inflation and help reduce the United States balance-of-payments deficit' as stated by the original writers of this legislation.

RECOMMENDATIONS

1. Accurate Automation has unique knowledge of how successful the STTR program has been for our company, with Wake Forest University, Old Dominion University and the University of Maryland. It is our view that the new STTR program, like the SBIR program, is meeting and exceeding all of the objectives stated in 15 U.S.C. 638, and the objectives of the legislation. The two programs are different and address two different requirements in technology development. The only problem we see with the STTR program is that the DOE National Labs are still resisting the program and they need to be told that they will be judged on how they perform in getting STTR agreements that are commercialized. This can be done in the congressional language by asking for a GAO report on how successful SBIR and STTR companies are doing with STTR agreements with the National Labs.
2. Extend the SBIR sunset clause to end in 2007 and have the STTR law now concur with the SBIR sunset clause.
3. Increase the STTR amount to 1% of the extra-mural research.
4. Allow the funding agreements to have up to $125,000. for Phase I and $750,000. for Phase II.
5. With the exception of the present 10 federal agencies that participate in today's Small Business Innovation Research program, there is little opportunity for small business to develop research and technology for the other federal agencies like the Department of Justice, TVA, Department of Interior, GSA or the Smithsonian, to name a few. We need to modify the law to encourage the other agencies to be able to place topics in the SBIR and STTR solicitations. The agencies with $20,000,000 through $100,000,000 and the smaller SBIR and STTR agencies should be encouraged to have an omnibus solicitation managed by SBA or possibly be incorporated into the NSF or HHS or any other SBIR STTR solicitation. I believe that VA, NTSB and TVA would volunteer topics for the program, with encouragement from the Congress. They need to know (from the Congress) that the language in 15 USC 638 does not prohibit them from having topics and they may use an SBA or existing agency solicitation.
6. Allow Research Hospitals to participate in the STTR program.
7. 15 USC 638 needs to be modified to allow for one agency having awarded a Phase I, and allow another agency to take over the Phase II or participate in the Phase II if it helps that agency's mission. This would be applicable at NASA

and DoD, DoE and NASA, DoD and DoE, DoD and HHS and NASA and HHS, to name some areas where there is common interest.

8. The present law has a flaw in allowing for a bailment of a Phase II proof of concept device. It does not allow for vestment of the proof of concept device if it is a perishable. If the term bailment is modified to include vest title subject to the Government not being charged in the future for depreciation or use on a future Government contract, this would be very important.
9. All payment on SBIR funding agreements needs to be made within 12 months of the requirement not subject to the audit after the 12th month.
10. The outside peer review is presently in a lot of cases biased opinions from potential competitors and therefore should be "unbiased peer or government scientist review." It is better to have a government scientist as the expert.
11. The term "cost sharing" should be deleted. It is being abused and is keeping startups from starting in the program. The FASTRACK at DoD and other agencies rewards those that come to the table with money. The FASTRACK did not exist when cost sharing was inserted into the law.
12. The "rights to data" needs to be modified to include inventions and patents. Because of the length of time to get a patent, the rights need to be extended to 8 years to allow enough time to get the commercial benefits. If the Government gets a paid up license, the patent cost should be an allowed overhead expense.
13. The Phase III needs to be exempt from 10 USC 1023. It is by definition then a "unique invention", and this would be a waste of procurement dollars to compete something that is judged "unique" at the discretion of the government.
14. The discretionary technical assistance section should be used to fund government outreach and commercialization as well as through a contractor who may not be able to help. Allow for not to exceed 1% of the SBIR and STTR federal funding to be used by the federal agency for the outreach activities under discretionary technical assistance section.
15. There are people at the Office of Management and Budget who would destroy or change the SBIR and STTR programs to support their own constituencies. We need to guard against those people who adjust what qualifies for extra mural research, or who wish to reduce the amount of funding going into SBIR. This is especially critical in the National Science Foundation, Department of Commerce, Department of Defense and National Aeronautics and Space Administration.
16. The (CRADA) does not work for small businesses. The amount of paper work and bureaucracy needs to be reduced for the good of the program. The question of *how does this affect my rates from DoD and NSF* needs to be

resolved. Small businesses do not have the money or legal advisors to develop CRADA. The Congress might allow a CRADA to become an option at the end of an SBIR/STTR Phase I or Phase II awards, with the agreement of both the SBIR company and the sponsoring agency.

17. Encourage the National Lab to show how they can parley the SBIR/STTR products into being commercialized into dual use technology and become real American made products. STTR firms with Phase II awards should be able to play a key role in commercialization of the results. This will allow an important national need to be addressed and the technology developed.

I compliment this committee and the Congress on developing the SBIR and STTR programs. I want to thank you for your time and attention. I hope this information will help in extending the Small Business Technology Transfer Research Program.

Respectfully presented this the 26th day of May, 1999.

Robert M. Pap
President,
Accurate Automation Corporation

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